86-01527/

Canadian Technical Report of Fisheries and Aquatic Sciences

Technical reports contain scientific and technical information that contributes to existing knowledge but which is not normally appropriate for primary literature. Technical reports are directed primarily toward a worldwide audience and have an international distribution. No restriction is placed on subject matter and the series reflects the broad interests and policies of the Department of Fisheries and Oceans, namely, fisheries and aquatic sciences.

Technical reports may be cited as full publications. The correct citation appears above the abstract of each report. Each report is abstracted in *Aquatic Sciences and Fisheries Abstracts* and indexed in the Department's annual index to scientific and technical publications.

Numbers 1-456 in this series were issued as Technical Reports of the Fisheries Research Board of Canada. Numbers 457-714 were issued as Department of the Environment, Fisheries and Marine Service, Research and Development Directorate Technical Reports. Numbers 715-924 were issued as Department of Fisheries and the Environment, Fisheries and Marine Service Technical Reports. The current series name was changed with report number 925.

Technical reports are produced regionally but are numbered nationally. Requests for individual reports will be filled by the issuing establishment listed on the front cover and title page. Out-of-stock reports will be supplied for a fee by commercial agents.

Rapport technique canadien des sciences halieutiques et aquatiques

Les rapports techniques contiennent des renseignements scientifiques et techniques qui constituent une contribution aux connaissances actuelles, mais qui ne sont pas normalement appropriés pour la publication dans un journal scientifique. Les rapports techniques sont destinés essentiellement à un public international et ils sont distribués à cet échelon. Il n'y a aucune restriction quant au sujet; de fait, la série reflète la vaste gamme des intérêts et des politiques du ministère des Pêches et des Océans, c'est-à-dire les sciences halieutiques et aquatiques.

Les rapports techniques peuvent être cités comme des publications complètes. Le titre exact paraît au-dessus du résumé de chaque rapport. Les rapports techniques sont résumés dans la revue *Résumés des sciences aquatiques et halieutiques*, et ils sont classés dans l'index annual des publications scientifiques et techniques du Ministère.

Les numéros 1 à 456 de cette série ont été publiés à titre de rapports techniques de l'Office des recherches sur les pêcheries du Canada. Les numéros 457 à 714 sont parus à titre de rapports techniques de la Direction générale de la recherche et du développement, Service des pêches et de la mer, ministère de l'Environnement. Les numéros 715 à 924 ont été publiés à titre de rapports techniques du Service des pêches et de la mer, ministère des Pêches et de l'Environnement. Le nom actuel de la série a été établi lors de la parution du numéro 925.

Les rapports techniques sont produits à l'échelon régional, mais numérotés à l'échelon national. Les demandes de rapports seront satisfaites par l'établissement auteur dont le nom figure sur la couverture et la page du titre. Les rapports épuisés seront fournis contre rétribution par des agents commerciaux.

Canadian Technical Report of
Fisheries and Aquatic Sciences 1355

MARCH 1985

OBSERVER PROGRAM TRAINING MANUAL - NEWFOUNDLAND REGION

by

D. W. Kulka and J. R. Firth

Fisheries Research Branch
Department of Fisheries and Oceans
P.O. Box 5667
St. John's, Newfoundland A1C 5X1

This is the eighty-fifth Technical Report from
Fisheries Research Branch, St. John's, Newfoundland.

(c)Minister of Supply and Services Canada 1985

Cat. No. Fs 97-6/1355 ISSN 0706-6457

Correct citation for this publication:

Kulka, D. W., and J. R. Firth. 1985. Observer Program Training Manual - Newfoundland Region. Can. Tech. Rep. Fish. Aquat. Sci. 1355: ix + 171 p.

TABLE OF CONTENTS

Page

Introduction 1

Methods 2
  Briefing 2
  Deployment Initiation Procedures 3
  Techniques of Observing Sets 5
  Method for Filling out Set and Catch Forms 11
  Collecting Set Details 17
  Sampling at Sea 17
  Techniques of Sampling 19
  Sampling Requirements Summary 26
  Coding Length Frequency Sheets 28
    Groundfish 28
    Grenadier 31
    Shrimp 32
    Large Pelagics 35
  Observing and Sampling - Special Cases 35
    Canadian Vessels 35
    Spanish Pair Trawlers 36
    Catcher-Processor Fleet 37
    Gillnetters 37
    Longliners 40
  Other Activities 43
    Sampling Report 43
    Catch/Effort Summary 43
    Fishing Pattern Maps 45
    Conversion Factors Analysis 45
    Gear Diagrams 53
    Other 53
  Debriefing 53

Discussion 54
  The Observer Manual and its Use 54
  Data Utilization 54

References 56

List of Tables

Table	Subject	Page
1	Equipment list - Observer Program...........................	59
2	Summary of Sampling Techniques..............................	60
3	Selected Experimentally Determined Conversion Factors.......	61

List of Figures

Figure No.	Subject	Page
1	Chart of the Canadian Atlantic Region showing major fishing banks..	63
2	Observer Program Briefing Instructions................	64
3	Post-trip performance assessment-Newfoundland Observer Program...	65
4	Ports of embarkation and disembarkation of foreign and Canadian fishing vessels in the Newfoundland Region...	66
5	Layout of the factory area for the Kuprin, a large Russian factory ship..................................	67
6	Estimating total weight of the catch while still in the net using the splitting strap method..................	68
7	Diagram of deck holding bin and measurements required for volumetric calculation (L = length, W = width, and H = height of holding area)............	68
8	International production log..........................	69
9	International fishing log.............................	70
10a	Observer Program set detail sheet.....................	71
10b	Observer Program catch detail sheet...................	72
11	Map illustrating fishing position with respect to NAFO areas..	73
12	Illustrations of the gonads of various commercial species..	74
13a	Position of gonads in flatfish (immature).............	82
13b	Position of gonads in flatfish (mature)...............	83
14	Observer Program length frequency sheet for groundfish..	84
15	Grenadier sampling techniques.........................	85

Page

16 Observer Program length frequency sheet for grenadiers.................................. 86

17 Observer Program length frequency sheet for shrimp..... 87

18 Shrimp stock areas (Labrador)........................... 88

19 Instructions for measuring large pelagic species....... 89

20 Observer Program length frequency sheet for large pelagic species............................ 90

21 Catcher-processor data collection methodology.......... 91

22 Catch and effort data collection form for use on processing vessels.................................. 92

23 Observer Program set and catch detail sheet with categories modified for gillnet trips............. 93

24 Observer Program set and catch detail sheet with categories modified for longliner trips........... 94

25 Observer Program sampling report sheet................. 95

26 Observer Program catch-effort work sheets.............. 96

27 Observer Program catch-effort summary sheets........... 97

28 Observer Program set position listing form............. 99

29 Observer Program trip map.............................. 100

30 Observer Program frequency sheet completed for a conversion factor experiment..................... 101

31 Observer Program conversion factor data sheet.......... 102

32 Observer Program fillet production data summary........ 103

33 Observer Program block weight data sheet............... 104

34 Diagram of bottom trawl with required data entries..... 105

35 Diagram of midwater trawl with required data entries... 106

Page

36 Observer Program tagged fish data record............... 107

37 General whale sighting form............................ 108

38 Age and Growth Sheet................................... 109

39 Fish size distribution of a theoretical stock.......... 110

40 Illustration of how the otolith is used for ageing..... 111

41 Fisheries Observer Program flowchart illustrating program structure and functions........................ 112

LIST OF APPENDICES

Page

1. Stock area for commercial species.................................. 113
2. Observer trip report... 114
3. Coding specifications.. 137

ABSTRACT

Kulka, D. W., and J. R. Firth. 1985. Observer Program Training
Manual - Newfoundland Region. Can. Tech. Rep. Fish. Aquat. Sci.
1355: ix + 171 p.

In 1978 the Newfoundland Fisheries Observer Program was implemented in response to the newly extended zone of fisheries jurisdiction. The program has a dual function to provide additional surveillance capabilities and collection of biological data and catch effort statistics. The Observer Training Manual concentrates on the latter function of the observer. It provides the basis for observer training and acts as a comprehensive reference for the observer while at sea. The manual outlines, in a stepwise fashion, the requirements of an observer from the start of deployment to the final debriefing. Discussed in detail are the methods for estimation of catch weight and composition, sampling techniques for various species, data collection formats, and coding specifications presently in use. Given the wide diversity of countries, vessels, gears, and species being fished, specialized collection formats are presented with specific instructions for these special situations.

RÉSUMÉ

Kulka, D. W., and J. R. Firth. 1985. Observer Program Training
Manual - Newfoundland Region. Can. Tech. Rep. Fish. Aquat. Sci.
1355: ix + 171 p.

En 1978, le Programme des observateurs pour les pêches de Terre-Neuve a été mis en oeuvre à la suite de l'extension de la zone de compétence sur les pêches. Le programme a une double fonction: une capacité de surveillance supplémentaire et la collecte de données biologiques et de statistiques sur l'effort de capture. Le manuel de formation de l'observateur porte surtout sur cette dernière fonction. Il constitue la base pour leur formation et sert de référence détaillée pour l'observateur en fonction. De plus, il expose par étapes les tâches, du début de l'entrée en fonction jusqu'à la séance finale de comptes rendus. Sont examinés en détail les méthodes d'estimation du poids et de la composition des prises, les techniques d'echantillonnage de diverses espèces, les modèles de çollects de données et les descriptions de codes actuellement utilisés. Etant donné la diversité des pays, des bateaux, des engins et des espèces exploitées, des modèles spécialisés de collecte de données sont présentés avec des instructions précises pour ces cas spéciaux.

INTRODUCTION

Traditionally, biological information from commercial fisheries has been collected by technicians from landed fish in shore plants and catch and effort has been obtained from logs recorded by vessel captains. These data, particularly catch figures, were often incomplete or compiled in an inappropriate manner. However, more detailed and objective set by set information can be obtained by trained and independent observers stationed onboard vessels during the actual fishing operation. The advantages of having observers as seagoing collectors of biological data and catch/effort statistics have been recognized by Paulsen (1956) and others long before the existence of such a system. For fisheries now under Canadian jurisdiction, the concept of placing observers on foreign vessels was first conceived in 1976 by the International Commission for the Northwest Atlantic Fisheries (ICNAF), then the regulatory body for fisheries in the Canadian Atlantic area. Although the objectives and coverage of this experimental program were very limited, the usefulness of scientific information derived from it demonstrated a need for the project to continue in future years. Not only was it a source of detailed data for assessing the resource, it also provided a means to monitor adherence to fishery regulations in a quantitative manner.

Plans formulated in 1977 integrated the concepts of data collection and vessel monitoring (surveillance) and this system was applied to the French fleet fishing in the Gulf of St. Lawrence. It led to the creation of the present joint scientific/enforcement observer scheme with a mandate to cover offshore and some inshore activity in the Canadian Atlantic. In 1980, foreign coverage was expanded and the program was also extended to a portion of the domestic offshore fleet. Until 1981, operations were carried out by the Newfoundland and Scotia Fundy components, the former responsible for coverage in Subareas 0, 2, and 3 (Davis-Strait to the Grand Banks, an area of about 500,000 sq. mi.), the latter responsible for Subarea 4 (Scotian Shelf), with overlapping responsibility in the Gulf of St. Lawrence. (Refer to Fig. 11 for the NAFO Subareas.) Figure 1 shows the southern area of observer operations. In 1981, the Gulf Region Observer Program was introduced with jurisdiction in Div. 4R, S, T, and 3Pn on the domestic and French fleet. The aim of these programs is to provide a system of observation and data collection to assist in the assessment and management of the fishery within the newly extended zones of jurisdiction. They provide a cost effective method of monitoring compliance of foreign and domestic fleets to current regulations and collecting reliable technical and biological data for all offshore commercial fisheries. The three programs, in conjunction with shore sampling systems, facilitate comprehensive commercial fisheries data acquisition and regulation compliance for Atlantic fisheries. It is the former aspect which this manual stresses.

Scientific observer responsibilities can vary depending on type and circumstances of a particular trip. In general, observers are charged with collecting resource data to be used in establishing stock distribution patterns, providing catch and effort statistics and biological information for stock assessment, examining the effects of vessel and gear types on the exploited fish stocks, recording the associated by catch and discard data, collecting data on rare fish, invertebrates, and marine mammals, collecting information on fleet fishing patterns, and collecting detailed production data.

A further discussion of the history and accomplishments of the first four years of the scientific side of the operation can be found in Kulka and Waldron (1983).

A very complex fishery exists within Atlantic Canada's 200 mile limit consisting of about 27 stocks (10 species) from 17 NAFO Divisions for 15 countries. (A list of stocks is given in Appendix 1.) In order to assist in fulfilling the data collection and monitoring mandate, this manual has been created as a scientific guide for fisheries observers of the Newfoundland Region, but because of the general approach used it can be adapted as a guide for similar programs in other areas. Data collection formats are suitable for a wide variety of both mobile and stationary gear fisheries in the Canadian Atlantic and other parts of the world. The manual describes in a logical, stepwise fashion, the scientific duties that fisheries observers are required to perform at sea in order to obtain the appropriate data for management of stocks. Included are sections on how to observe sets, collect set details, techniques of sampling, how to handle special projects and situations, and briefing and debriefing procedures. Practical techniques are presented in as general a way as possible such that they can be applied to most mobile and many types of fixed gear fisheries. The final section presents a brief explanation of how the managers use the data and why precision in the work of the observer is essential. Also, a variety of papers are referenced that can provide background material on sampling, species distribution, fishing gear and other related topics. This manual is designed to provide the basic biological text for training sessions and as a comprehensive reference for fisheries observers in the field. Documentation outlining the surveillance aspects of the job is separate.

METHODS

BRIEFING

Prior to deployment, a briefing by company personnel prepares the observer for specific tasks and situations that might be encountered. Company management, at this point have received instruction from Department of Fisheries personnel on various aspects of the deployment and any specialized requirements. At the office of the company all necessary equipment is distributed. A complete list of equipment is given in Table 1. Not all listed hardware would be required for any particular trip but the kit should be inspected against a checklist to insure that it is complete.

At this stage, the observer is briefed on details of vessel design, such as accommodations, production layout and equipment. Any past infractions or special problems previously encountered in the fishery are outlined to alert the observer to situations that may arise during the trip. Pertinent regulations are also reviewed and a computer printout showing historical catch rates, vessel size, tonnage processing capacity, crew size, etc. is made available. Review of these data constitutes a general familiarization with the fishery and more specifically the vessel to be observed. Special surveillance projects are also outlined at this time. The briefing outlines basic sampling requirements, reviews fleet characteristics, provides information on the stocks to be observed, and supplies instructions for special projects. If for example, the target vessel is a Portuguese stern trawler licenced to fish cod in Div. 2J+3KL, historical catch rates and by-catch levels for this fishery would be covered. Auxillary details on fleet activity would be made available and a specific sampling strategy for the target species, northern cod, would be discussed.

To provide a written record, the above information is summarized on a "Briefing Instruction" sheet (Fig. 2) accompanied by a description of performance from previous trips. This form provides the basic work plan for the upcoming deployment. The other basic document reviewed during this session is the "Post-trip Performance Assessment" (Fig. 3). It describes specific problem areas as determined from the previous deployment along with a general assessment of all past work. As such, it acts as a feedback mechanism to ensure a continuing appropriate level of performance. The briefing session as a whole is designed to anticipate and thereby avoid potential problems which might arise in the unsupervised and isolated working environment.

DEPLOYMENT INITIATION PROCEDURES

Travel to another port to join the assigned vessel is often necessary, particularly in the case of domestic trips. Figure 4 shows possible sailing and landing locations for offshore fleets fishing in the Northwest Atlantic. Also, on occasion, several observers may be transported to the fishing grounds on a single vessel and then dispersed to other vessels in the fleet. This involves transfer at sea using small craft. Regulations state that transfers will occur only during daylight hours and standards are set on the safety of boarding craft and ladders.

The assigned vessel may be from a fleet of any of about 10 countries fishing in the zone. Production layout, fish catching design and living conditions vary widely. Descriptions of some vessel types can be found in Babin and Wood (1981) and Greenway (1981), providing useful reading during the preparatory phase of the deployment. Studying historic trip reports dealing with the assigned vessel or fleet is also helpful.

The initial portion of the deployment is a critical period. At this stage the appropriate contact must be established, preliminary data obtained and most importantly, a data collection system established. This lays the foundation for all subsequent activities. As such, it is necessary to follow a set pattern during initiation procedures working in conjunction with key officers (many on foreign vessels can communicate in English).

Access to the catch at various stages of processing is essential. Location(s) for observing amounts in the catch and catch composition depend on how it is handled once it comes on board the ship. On many foreign trawlers, it is emptied from the net directly into an open hopper on deck where it can be observed and composition of the catch determined. Permission of the captain to hold the catch in the deck bin for sorting purposes is essential. Most often the fish are held on deck for a short period of time, as a matter of course. Insure that the next set has been shot away in order to avoid dangerous contact with the fishing gear.

Next, arrange acquisition of set details from the captain. For every set that comes on board, access to the following is required:

1) starting position of each set (cross check with fishing log)
2) start and finish time of sets (cross check with fishing log)
3) depths fished
4) vessel side number (confirmation)
5) vessel horsepower (confirmation)
6) detailed technological gear data
7) detailed technological data about the processing machinery
8) a copy of the license
9) the fishing and production logs

Finally, consult with the captain or his designate to select a sampling station where there is access to the catch before the crew handles it. Figure 5, which illustrates the layout of a typical factory with sampling positions A, B, C, and D, can be consulted as a guide during this procedure. It is essential that the sample of fish collected must be representative of the catch. Establish a routine that insures access to the fish before they are sorted by the crew. Culling must not occur prior to selection because this can result in disproportionate amounts of small or large fish in the sample. The optimal sampling position, near the point where fish enter the processing room, allows for sample removal before sorting and processing. At this location there is a maximum likelihood of obtaining a random sample. It is also important at this time to become familiar with the processing machinery in order to carry out conversion factor experiments later. Further details on sampling are given in the section, Techniques of Sampling.

To summarize, while in transit to the fishing grounds, study all procedural outlines, including memos, briefing instructions, and assessments. Become familiar with all aspects of the ship's fishing operations within the first 2 days of the trip. Establish and maintain a comprehensive pattern of observation, sampling and collection of set details. Observers should regularly alter hours of observation and sampling to insure a good balance of day and night sets are observed and sampled. By following the above procedure, the proper groundwork will become established. Thorough preparation is a key to a successful deployment.

The following sections present descriptions of various required duties highlighting potential problems and how they should be dealt with. In the unsupervised environment, judgement, initiative, and adaptability are the key when applying standard techniques described below to the many and varied situations encountered onboard Canadian and foreign vessels.

TECHNIQUES OF OBSERVING SETS

Estimating catch, bycatch, discards and gathering accompanying effort data is a prime objective which occupies a major portion of the time at sea. There are many stages associated with estimating catches with the results serving both scientific and surveillance ends. The basic unit of observation is the set, defined as setting and retrieval of the fishing gear resulting in a catch of target and incidental species. In the offshore fishery, several types of gears are used to capture fish but in the majority of cases fishing is executed using the otter trawl which is set from the stern or side of the vessel. This gear constitutes a large open-ended bag shaped net dragged along the bottom or in midwater, capturing a portion of the fish in its path. Detailed descriptions of net designs, which are highly variable, can be found in Anon. (1964), Garner (1967 and 1978), Kristjonsson (1959 and 1971) and Thompson (1978). The following section applies mainly to otter trawls but the basic techniques are universal for all gear types. Differences in set observation techniques used with other gear types are dealt with in later sections of this manual.

An observed set is one where the observer obtains an accurate breakdown by weight of species through direct observation. The minimum requirement for proportion of sets observed is 75% of the total that occur during the trip. Utilization of unobserved catch data can produce an unreliable result because of the high variance encountered in the catches from set to set, therefore a high percentage of observed sets is desirable. The number of sets fished per day can vary from one to ten depending on the directed species, the gear used, the catch rate and other circumstances. When the number of sets fished per day is low, 100% observation is possible. Over the past five years, an 85% coverage level has been maintained, thus, there should be no difficulty in exceeding the minimum required level under most circumstances. Perform detailed catch estimates for every set. As indicated earlier, it is important to obtain a good balance of day and night sets because fish size and catch composition can vary diurnally due to differential vertical migrations. At night certain species tend to rise off the bottom, thereby decreasing the apparent relative abundane of night bottom catches.

Observation of the set commences when the net comes on board. From this point on, effort must be dedicated to determining and recording how much of each species of fish has been caught and how much of the catch is discarded. The following section follows step by step a specific example of redfish caught by otter trawl on a foreign vessel, but the techniques described generally apply to any circumstance.

The otter trawl sweeps a specific area of the ocean floor, therefore, the amount of fish caught by this type of gear per unit time likely reflects abundance of fish in the area. Also, the quantification of total catches leads to an estimate of mortality in the population due to fishing, making the acquisition of catch data a primary function of the observer. It is important to obtain the best possible estimates of catch in order to provide reliable data for stock assessment. This can be accomplished by adapting the following techniques.

The first of three independent estimates of catch weight is made as the net comes on deck. It involves a direct observation of the filled codend, but does not include a species breakdown because individuals are not visible. This method is of particular value on Canadian vessels where access to the fish after removal from the net is limited. The captain is familiar with the gear and its capacity and can be consulted in this context, but it is the aim of the observer to derive an independent estimate of catch weight and composition. If this first estimate differs from that of the captain, note it on the comments section of the set and catch record. This information can be of use in a surveillance context.

One method of estimating total catch weight before it is emptied from the net involves counting the number of splitting strap sections to where the net is filled (Fig. 6). This method is suitable only for very large catches. If the volume of fish contained between each splitting strap is known, then multiplying this amount by the number of sections filled provides an estimate of the catch. Again, captains are generally knowledgeable about their gear capacities and should be consulted. Proficiency in this procedure comes with experience. It is, however, the least accurate of the methods outlined and must be used only as a preliminary estimate on all vessels.

Adaptation of estimating procedures will depend on the production layout of the vessel. Judgement is important in developing the catch observation strategy for a particular vessel. Each ship presents a unique situation with respect to the disposition of the catch. A separate section dealing with the difficulty of obtaining accurate estimates on Canadian vessels is presented later. However, on most foreign vessels, the catch is first emptied from the net into trawl deck holding areas and held there for short periods before being released to the hoppers below. The second method, holding area observations provides the best opportunity to carry out visual observations of the catch, specifically eyeball estimates of both total tonnage and species composition while the fish are held in the open hoppers.

Before the holding area technique can be applied it is necessary to determine the weight capacity of the bin by volumetric technique. First measure, then multiply L (length), W (width) and H (height) of the bin to yield its volume as illustrated in Fig. 7. As a simple example, if the length of a rectangular bin is 8 m, the width 5 m, and the height 1 m, then the bin volume would be calculated as 8 x 5 x 1 = 40 cubic metres (m^3). If the bin is odd shaped, divide it into several symmetric portions, estimate the volume for each portion, and add them together.

In conjunction, weigh at least 5 baskets of a representative mix of fish from the catch to obtain an average weight per basket of fish. Next determine volume of the baskets used. In order to determine sample basket volume (V) use the following formula:

$$V = \pi r^2 \times H \qquad \text{Equation 1}$$

where $\pi = 3.14$
r = basket radius = ½ diameter (cm)
H = depth of basket (cm)

The weight per volume (kilograms per cubic metre) will vary with species or mix of species in the bin, therefore, weigh new samples of fish and recalculate every time the catch composition changes. Flatfish, for example are more densely packed than cod and are therefore heavier per unit volume.

Knowing the volume of the holding area, the average basket volume and average weight per basket, the number of kilograms in a full bin can then be derived using the following formula:

$$C = \frac{B}{V} \times W \qquad \text{Equation 2}$$

Where C = catch weight (kg)
B = bin volume (m^3)
V = sample basket volume (m^3)
W = average weight of samples in baskets (kg)

If, for instance, the volume of the holding area is estimated at 40 m^3, the average basket weight full of the appropriate species mix is found to be 40 kg, and the volume of the basket used is 0.4 m^3 (calculated from equation 1), then equation 2 can be solved as follows:

$$C\ (kg) = \frac{40}{0.4} \times 40$$

$$= 4000\ kg$$

$$= 4\ MT$$

Thus, it is calculated that 4 tonnes of the observed species mix would fill the 40 m^3 bin. If the bin was filled 2½ times by the net contents for a particular set, the calculated catch estimate would be 2½ X 4 = 10 MT. This volumetric method of calculating weight is more accurate than an eyeball estimate from cod end size and must be used where open bins are used to hold the fish. The same basic method can also be applied when more than one holding area is used by adding together the estimates for each.

At this stage, species mix must be determined by entering the holding area and thoroughly examining all layers of fish. Sort through the catch as it sits in the open hopper to determine how much of each species is present, including minor types. Estimate by eye the relative proportions in the bin. To do this, inspect not just the surface but lower layers as well, sorting carefully through the catch. It is important to examine all layers for two reasons. First, certain species tend to dominate at the top of the pile and thus, could bias the estimate of the percentage of the species present. For example, when redfish are brought to the surface, their air bladders expand as the pressure is lessened which causes them to float to the top of the net. When they are dumped into the bin, they cling to the mesh and as a result, tend to be emptied last. If the catch consists of mixed witch and redfish, then the witch will fall from the net first and will be less visible. By observing only the surface layer, the proportion of redfish in the catch may be overestimated. Second, less common species in the catch are easily missed if covered over by the dominant species. When only a few individuals of a bycatch species have been taken, such as wolffish, they may be hidden from view. One of the major advantages of observer collected catch data over that obtained from fishing logs is more accurate estimates of bycatch. It is, therefore necessary to determine as accurately as possible proportions of all species present.

A supplementary method used to estimate species composition involves watching the fish pass from the holding area on the upper deck to storage hoppers below decks. As the fish pass through the access shute, all layers of the catch in the bin are exposed. This method should not be used exclusively, but in conjunction with the bin sorting procedure. It is of particular value for spotting less common species.

After finalizing this second estimate of catch weight which also provides for a species breakdown, record the figures on scrap paper. For example a written record of the redfish catch breakdown and total weight might appear as follows:

Catch for Set 26 - Deck Estimate - May 26, 1980

1.	Redfish (mentella)	55%	.55 x 10 MT	=	5.5 MT
2.	Redfish (marinus)	3%		=	0.3 MT
3.	Witch	35%		=	3.5 MT
4.	Northern Wolffish	2%		=	0.2 MT
5.	Striped Wolffish	1%		=	0.1 MT
6.	Turbot	3%		=	0.3 MT
7.	Roundnose Grenadier	1%		=	0.1 MT
8.	Black Herring	2 Specimens			3 kg
9.	Tapirfish	10 Specimens			10 kg
10.	Neolythodes (Crab)	7 Specimens			2 kg
			Total	=	10,015 kg

This represents the first record of a detailed breakdown of the catch. However, further refinement of the bycatch estimate is required and this can be accomplished by watching for species that might have been missed during the previous observations. These data can best be collected as the catch is released from the holding bins through the shutes onto the conveyor belts into the processing area (refer to Fig. 5 for an example of a factory layout).

At this point the fish may be handled in several ways. They may be processed by a variety of methods and ultimately frozen, put on ice, made into meal or discarded. If discarded, the amount by species must be estimated and recorded. Only fish rejected whole are classified as discards. Estimating numbers and weights of whole fish discarded can be quite a difficult task because several crew members may simultaneously be discarding into separate shutes. The most accurate method is to weigh the discards directly, but this is only possible when amounts are small. If this is not possible, observe each of the crew for a set period of time, recording what is going over the side, then estimate how much would be discarded by each individual over the whole period. Average the results and adjust to the total processing time.

Such processing room observations will lead to a revision of the original deck estimates. For example, in a catch of redfish, 20 previously unobserved tapirfish may be seen on the belt, all of which are discarded. If half of the catch has been observed coming through the processing area, then one could extrapolate that about 40 tapirfish were taken and subsequently discarded. The revised catch list would read as follows:

Catch for Set 26 - Processing Room Estimate - May 26, 1984

1.	Redfish (mentella)	5.5 MT
2.	Redfish (marinus)	0.3
3.	Witch	3.5
4.	N. Wolffish	0.2 (all discarded)
5.	Str. Wolffish	0.1 MT
6.	Turbot	0.3 MT
7.	Roundnose Grenadier	0.1 MT (all discarded)
8.	Black Herring	3 kg (all discarded)
9.	Tapirfish	40 spec. X 1 kg = 40 kg (all discarded)
10.	Neolythodes	2 kg (all discarded)
	New Total	10,045 kg (345 kg discarded)

In a third stage before recording on the set and catch sheets, the estimate of the catch still requires further refinement by cross checking the figures with those recorded in the Production Log (Fig. 8) and in the International Fishing Log (Fig. 9). Blanks of these logs are distributed to each vessel with the fishing license. They must be filled out by the captain or his designate for each day (Production Log) or set fished (Fishing Log) as a condition of license. Each provides important information for the observer. Production figures (amount of product in the hold) are generally quite accurate, and can provide the basic information from which a reliable estimate of the whole weight of kept species can be obtained. This is accomplished by the use of a product to whole weight conversion factor. Production weight data derived from volumetric estimates of product in the hold are multiplied by a product to round weight conversion factor to yield the round weight values entered by the captain into the fishing log (see section on Conversion Factor Analysis for a detailed description of production methodology).

In the case of frozen products, the captain of the vessel determines product weight by multiplying the number of frozen blocks of product by the average block weight, i.e. 451 blocks with an average weight of 15 kg which were produced from a particular set would yield a 6765 kg estimate of product weight. After the production figures have been compiled and recorded from the previous day by the fishing master, the observer can utilize these figures to cross check the values estimated for the corresponding sets. The Production Log figures are recorded on a daily rather than set by set basis, therefore, they must be compared with observed daily estimates. The observer must apply conversion factors to the Production Log figures and compare these estimated round weights with observed for the corresponding day. Factors used to convert the Production Log figures to round weight estimates can be taken from lists of factors from previous deployments or obtained from the ship's list. The latter source does not necessarily provide an accurate value and should be used only when no other data are available. Make a list for each species and product type as follows:

Production Log Conversion Factors

Species	Process	Derived factor	Ship's factor
Redfish (both species)	Fillet	3.0	2.8
Witch	Fillet	2.7	2.4
Turbot	Gutted head off	1.5	1.5
Other	Meal	8.0	6.0

Following through the example, Fig. 8 represents the Production Log record for May 26, the day being checked. Apply the above derived conversion factors to the Production Log figures from May 26 as follows:

May 26 Production Figures

Species	Product Weight (kg) (Production log)		Conversion Factor		Whole Weight (kg)
Redfish	6767	X	3.0	=	20,301
Witch	5158	X	2.7	=	13,927
Turbot	600	X	1.5	=	900
Other	388	X	8.0	=	3,104
			Total	=	38,232

Therefore, the total catch for May 26 estimated from production figures is 38,232 kg or 38.2 MT.

There now exists as many as three independent estimates of total observed daily catch some of which are broken down by set and/or by species. Utilize the available estimates and depending on the specific circumstances derive the best estimate of total daily catch. Adjust the breakdown for sets and species accordingly.

A final check can be done by comparing the derived set figures with those recorded in the Fishing Log (Fig. 9). The Fishing Log, as opposed to the Production Log, is recorded by set and therefore, can be compared on that basis to observed figures. The two estimates are independent, therefore they often differ. When differences occur, record observed figures on the set sheet while noting the nature of the discrepancies in the relevant section of the narrative observer report (see Appendix 2).

There are considerable differences between vessels in the disposition of the catch after it comes on board, therefore, adaptation to each situation is required by using modifications of the above described techniques. If, for instance, the catch is dumped directly below, the observer would have to depend on bag size estimates and converted product volume estimates in determining total catch weight. When the catch is salted, weight estimates from hold volumes must be done. On Canadian vessels, the catch is dumped into an open hopper below deck where the second estimate of total catch must be made (total weight and species breakdown) before the crew starts to sort and process the catch. The best time to determine catch composition on a Canadian vessel is during the time that the catch is being sorted. Production Log figures will not be available to assist in estimating amount of kept species since the majority of catches on domestic vessels are not extensively processed at sea. A more detailed discussion of problems encountered in observing sets on domestic vessels is presented in the Section, Observing and Sampling - Special Cases (Canadian Vessels).

When catches on foreign vessels are placed directly below into closed hoppers, species composition estimates are difficult to obtain and must be done after the fish emerge onto conveyer belts. This process takes time since the fish pass gradually onto the belts. In this situation, more emphasis must be placed on bag size estimates and Production Log conversions to obtain catch weights since volumetric estimates are unobtainable. However, this method need be used only rarely since few foreign vessels handle their catches in this manner. The object in observing a set during any deployment, regardless of vessel type is to obtain the best estimate of catch, by species. This can be accomplished by adapting and appropriately modifying the methods outlined above.

Accurate catch data are very important in fisheries management because they allow the assessment scientist to determine removals from the various stocks of fish. This enables the derivation of fishing mortality (F). If removal figures are inaccurate, then conclusions concerning stock size and allowable catch for the following year could be incorrect, possibly leading to inappropriate management decisions. It is, therefore essential to effectively apply as many of the above techniques as possible in order to obtain best estimates of catches.

METHOD FOR FILLING OUT SET AND CATCH FORMS

Records of catch, effort and other relevant data must be recorded in formal fashion to facilitate analysis. Figure 10 illustrates the computer form used for this purpose. Following through the example from the previous section, recording procedures for the set information are outlined below.

At the start of each trip always refer to the first set observed as 1. All subsequent sets coming on board will be numbered consecutively on the set sheet (Fig. 10a) regardless of whether it has been observed or not. For example, the formal catch record (Fig. 10b) can be completed after obtaining all relevant catch data for set 26 from the final catch estimates for that set:

Set 26 Final Estimates (All Methods) May 26

1.	Redfish (mentella)	5,500 kg	
2.	Redfish (marinus)	300	
3.	Witch	3,500	
4.	N. Wolffish	200	(discarded)
5.	Str. Wolffish	100	
6.	Turbot	300	
7.	Roundnose Grenadier	100	(discarded)
8.	Black Herring	3	(discarded)
9.	Tapirfish	40	(discarded)
10.	Neolythodes (Crab)	2	(discarded)

The record form is two sided with space on the front for set position, duration and vessel specifications and space on the reverse for catch figures (whole weights, including discards) and production methods used. The major codes required are listed at the bottom of the form. More detailed descriptions of codes (including all species codes) are listed in separate coding manuals and their use is elaborated in this section.

The first step in filling out the catch detail side of the form is to list common names of species in order of abundance in the column farthest to the left. Place the code of the corresponding species in the next column and then list the appropriate kept and discard weights as illustrated in Fig. 10b. A complete listing of species codes is given in the manuals by Akenhead and LeGrow (1981) for fish and Lilly (1982) for invertebrates. The column headed "Directed" will be coded as 1 for the main species sought (that species being directed for). In the case of foreign vessels, the license specifies the directed species. On Canadian vessels, consult with the captain to determine directed species (Canadian vessels are not restricted by license to fish one particular species although they normally direct for a particular one during each set).

The last column, headed "Processing", contains space to code up to three separate product forms that may have been used to process a particular species. For instance, if the 80% of the directed species, redfish, was converted to skinless, bone in, trimmed fillet, then the code for this process, 203, would appear on the first column of "Processing" under Proc. Code. A complete code list, including process codes, is located in Appendix 3 for this and all other observer forms. Detailed descriptions of process types can be found in Kulka (1983a). The 80% of fish processed in this manner would then appear in the adjacent column as 80. If the other 20% of redfish in that particular set were gutted and headed then the corresponding code, 104, would appear in the next column with 20 listed beside it (Fig. 10)b. Process codes and percentages would be listed for each species in turn unless they were discarded.

After the catch details segment of the form has been completed for a particular set, accompanying effort data would be recorded on the front of the sheet. This side of the form answers the questions when, where, and how the fish were caught, and how much effort went into their capture. As always, precision in recording coded data is essential. The top four spaces, "Vessel Name", "Country", "Observer Name", and "Directed Species" are not computer coded and are simply written in (Fig. 10a). For all other categories refer to code lists in Appendix 3 in conjunction with the following description to determine how the spaces should be filled.

The first 15 lines of the left column (headed as "Vessel Specifications"), specify how the catch is taken. The following is a detailed description of "Vessel Specifications" coding procedures. Refer to Fig. 10a.

Year: This slot contains two spaces for the last two numbers in the current year. If 1984, place 8 4 in the two spaces provided.

Country: Refer to the country code list in the Appendix 3. Following the example from the previous section, USSR would be coded as 2 0 in the two spaces provided. This country code reflects flag state (national registry) of vessel.

Side Number: The space for side number is 10 columns in length to accommodate all possible foreign and Canadian side numbers. This number can be obtained from the side of the vessel, the license, or the vessel specifications sheet. It is alpha-numeric and 3-10 digits long. In the example, for the ficitious Russian vessel MXS YVSKA, the side number MB 45172 would be written into slots 5-14. As in all cases, it must be right justified (the last figure on the right must fall in the space farthest to the right). Blank spaces on the left should not be filled.

Vessel Horsepower: This figure can be obtained from the vessel specification sheet and placed in the four spaces provided. In the example, a horsepower of 2600 hp is coded as 2 6 0 0 .

Trip Number: A trip number will be assigned before each deployment and must be coded on each set sheet as well as all other observer forms. This number will not change for the duration of the trip. For example, if the assigned trip number is "83", it will be coded in as 8 3 , right justified, with extra spaces left blank.

The above five categories will not normally change for the duration of the trip, enabling them to be precoded at a convenient time.

Set Number: The first set observed at the start of the trip will be designated as 1 and all subsequent sets during the trip will be numbered consecutively. If the set is not observed, it must still be assigned a set number and the catch and effort data recorded from the fishing log. In this way, effort (time spent fishing or amount of gear used) as well as set location would be known for those sets not observed. Following through with the example, the number 2 6 , the 26th set occurring during time on board would be right justified in the three slots designated for set number.

Gear Size/Type: The first two digits to the left of this two part, four digit code signify the size of the vessel (usually the larger the vessel, the larger the gear used and greater the effort). The codes for vessel size (tonnage class) are listed in Appendix 3.

Official gross registered tonnage, the weight of the vessel fully loaded with cargo normally recorded in Lloyds Registry, is used to classify the above category. These codes correspond with those used by the Northwest Atlantic Fisheries Organization.

The next two digits of this field signify gear type. A full listing of gear codes are given in Appendix 3. Following the example, the otter trawl (stern) would be coded as 01, therefore, the four digit value for a stern trawler exceeding 2000 GRT would be 0 7 0 1 .

Codend - Mesh Size: The observer is supplied with a gauge to facilitate measurement of the codend mesh size. Mesh size can vary with use, therefore it is necessary to measure the mesh frequently. If the mesh was found to be 12.0 cm (120 mm) then record as 1 2 0 in the three spaces provided.

Body Mesh Size: Measure mesh size of the body and record in mm in the space provided. Fill in 1 2 5 for a body mesh size averaging 125 mm.

Rollers - Size: Measure the roller diameter in cm (not the radius or circumference) and place this figure in the three digit space as 2 5 for a 25 cm roller.

Chaffing Gear (Topside): There are four types of legal topside chaffing gear. Determine the type used for the set and place the code in the space provided. In the example, an ICNAF chaffing gear was used and would be coded as 2 . Refer to Appendix 3 for a complete list of chaffing gear codes.

Number of Gillnets Hauled (Gillnet trips only): This space is reserved for gillnet trips where number of gillnets hauled for a particular day (0001 GMT to 2359 GMT) can be recorded. One set and catch sheet is filled out for each day of fishing activity (gillnets in water and/or hauled). For days when no nets are hauled but there are nets in the water, place a 0 (zero) in the blank space to the right. Further details regarding the gillnet fishery and how to observe and record data on these vessels are given in a later section.

Number of Hooks (Longline trips): Determine number of hooks hauled for the set being examined, then divide by 10. For example, if 29,000 hooks are hauled, divide 29,000 by 10 and record as 2 9 0 0 . The front portion of the set and catch sheet should reflect only the effort used to catch the fish weight listed on the reverse side. Detailed instructions for collecting and recording longline fishery data are given in a later section.

Net Damage: Observe and record any net damage that has occurred. If there is no damage, then code 1 in the space provided. If there is some damage that might not result in an appreciable loss of fish then record 2 . Damage, such as tears in the wing, would fall into this category. If the damage is extensive and might result in a loss of all or a substantial part of the catch, then record 3. Examples of this last type of damage are large tears in the codend resulting in loss of some of the catch or badly twisted gear preventing fish from being captured. Sets recorded as 3 will be removed from the catch per unit effort calculations. When the set is not observed, code as 1 signifying no damage unless it can be ascertained from the crew that damage had occurred.

IN/OUT 200 Miles: Indicate whether position at the start of the set is inside, recorded as 1, or outside, 2 of the 200 mile limit of Canada. The four fishing grounds lying outside 200 miles are southern Grand Bank (tail), eastern Grand Bank (nose), Flemish Cap and the eastern side of Davis Strait.

The next 13 categories to be filled in for each set deal with temporal and areal details. As such this information defines how much effort went into catching the fish and where it occurred. The slots are to be filled as follows:

Day: Record the day on which the set commences. If the net starts to fish at 2330 hrs. on May 26, and fishes into the following day then code 2 6 even though a portion of the set occurs on May 27.

Month: A numerical code should be used for the month in which the set occurs. In the example, code May as 5 .

NAFO Division: Using start latitude and longitude determine in which NAFO area the set occurred. Following the example, fishing occurred in 3L and therefore Division would be coded as 3 2 . Figure 11 illustrates the NAFO Division boundaries and Appendix 3 lists corresponding numerical area codes.

Unit Area: Determine the unit area where the set took place (Fig. 11) and place the three digit code into the space provided. In the example 47°40'N, 48°52'W falls into unit area 326 and would be coded as 3 2 6 . Always use starting position to determine unit area and NAFO Division.

Vessel Tow Speed: Record average vessel speed to the nearest 10th of a knot. Two spaces are allocated for this, with the space to the right of the dot for the decimal place. If the vessel averaged 4.2 knots during a tow and it would be recorded as 4 2 .

Start Latitude: Four spaces are provided to record the starting latitude. Degrees are placed in the first two spaces on the left, the minutes in the two remaining spaces. Do not put N and W to the right of the position. In the example, the starting latitude is 47°40'N. This would be recorded as 4 7 4 0.

Start Longitude: Use the same procedure as above to code longitude. Note: The starting position refers to the point where the net effectively starts to fish. The start position for otter trawl gear refers to the place where the net reaches the bottom, not where it is shot away. A midwater trawl, however, effectively starts to fish as soon as it is placed in the water.

Average Depth: Fishing depth should be recorded to the nearest metre. Following the example, the average depth of 530 m would be recorded as 5 3 0.

Start Time: At the moment the net actively starts to fish, time should be noted and recorded in GMT in the four spaces provided, using the 24 hour scale.

Following the example, the net started to fish at 4 o'clock in the afternoon GMT and would be recorded as 1 6 0 0.

Duration: When the net stops fishing, note the time and substract end from start time. Record to the nearest 1/10 of an hour. In the example, fishing stopped at 7:10 in the evening and therefore duration would be recorded as 3.2, indicating that the net fished for 3.2 hours or three hours and ten minutes. The following are set duration conversions from hours/minutes to decimal hours:

5 min. = 0.1 hours
10 " = 0.2 hours
15 " = 0.3 hours
20 " = 0.3 hours
25 " = 0.4 hours
30 " = 0.5 hours
35 min. = 0.6 hours
40 min. = 0.7 hours
45 min. = 0.8 hours
50 min. = 0.8 hours
55 min. = 0.9 hours
60 min. = 1.0 hours

Data Source: While a vessel is fishing the observer may not be able to perform detailed catch estimates for every set. When only two or three sets are done each day, 100% coverage can be achieved. If the set is observed record 1 under the data source category. If it is not, record 2 . The example indicates that the set was observed.

Directed Species: Foreign vessels are licenced to fish a particular species during a given period. The species named on the licence for that day is to be coded into the four spaces provided even if other species dominate in certain of the sets. A complete list of codes can be found in the vertebrates and invertebrate coding manuals (Akenhead and LeGrow 1981; Lilly 1982). Following the example, the code 792 signifies that redfish is the directed species. On Canadian vessels the captain is not restricted by license to a single species. Enquire before the set occurs as to what species is being pursued and record it in this category.

Number of Species: Once the catch record has been completed, add up the number of species recorded and place this figure in the two spaces provided. In the example, 10 species are recorded and this value is placed in the two spaces as 1 0 .

Quota: Determine which countries' quota is to be fished and fill in the appropriate country code corresponding to quota origin.

Trip Type: During the briefing session observers will be informed of the appropriate trip type to be coded. This category is necessary because of the many special arrangements between Canada and other countries resulting in atypical deployments.

The above category instructions summarize how the set sheet should be coded. The computer, which is the distination for these data is incapable of interpreting input, therefore, precision is essential. Once the set and catch sheet has been completed, check it over, eliminating all mistakes. Always use pencil so that changes can be made. At the end of each day, review the accumulated data sheets for that day so that peculiarities in the data can be detected. A final check must also be made at the end of the trip during debriefing.

COLLECTING SET DETAILS

Side number, vessel horsepower, and gear size can be determined by referring to the vessel specification sheet, attached to the license. Codend and body mesh should be remeasured every week because the gear can change shape with useage. Roller diameter should be measured at the beginning of the trip or whenever the gear is changed. Chaffing gear and strengthening ropes should be checked periodically. Ask the captain to supply information such as average vessel tow speed, latitude, longitude and depth for all sets. These data can also be obtained by referring to the International Fishing Log maintained on board. These records should be confirmed by taking readings from the appropriate electronic equipment.

For sets not observed, the set and catch data can be taken directly from the fishing log. It is particularly important that the proper effort (time spent fishing) is recorded for these sets. These data can be most easily collected the day after the set occurs.

SAMPLING AT SEA

As an introduction, the following condensed extract from Kulka and Waldron (1983) describes the benefits of sampling at sea:

> The need for observers at sea as collectors of biological data, particularly length and age samples, was recognized long before the existence of the Observer Program. Paulsen in (1956) noted the following: "The method (shore sampling) does not offer a reliable substitute for sampling at sea by means of observers. The sampling by observers, although more expensive (in money and time), must continue to be our main way of studying size-distributions." More recently T. Williams stated in Gulland (1977) that "Large well-equipped laboratories, complete with costly research vessels and highly qualified staff, attempt to carry out quantitative studies of fish stocks without utilizing the enormous amount of information relatively cheaply obtainable from the operations of the commercial fishing fleet. A properly organized program of work at sea on commercial fishing vessels and onshore at processing plants provides the basic data for removals by the fishery and also information on the abundance, distribution, migrations, and mortality of the exploited fish stocks." Certainly the benefits of an in situ data collection program has long been recognized.
>
> The Observer Programs for the three Atlantic regions collect not only biological but surveillance, and technological data as well. Such an approach is efficient because each task performed by the observer requires only a portion of the working day. Hence, all aspects including sampling can be done by a single observer per

vessel. Age, length, and other demographics can be extracted in a detailed manner and can even be taken from portions of the catch such as discards, landings, or size-culled fish. Extensively sampled sets can be recombined into any specified strata, properly weighted at each level. Length-age sampling of catches at a rate of 1 set per day can easily be achieved in conjunction with collection of catch and effort, surveillance and other data.

Presently there are about 40 stocks (15 species), fished by 15 countries in the offshore sector, composing about 220 strata. This presents an immensely large sampling problem because catches from each stock must be sampled adequately by country, gear, quarter, and month. Prior to 1978 (foreign) and 1979 (domestic) Canadian managers depended on data supplied to ICNAF (NAFO) by each country either from sampled landings or from sea samples done by technicians from each of the foreign countries. Inadequately sampled or unsampled stocks were not uncommon, particularly in the foreign sector, and the scientists responsible for assessment had little or no way of controlling sample quantity, quality, or distribution. Between country differences in measuring and recording methods for a number of species made the data incompatible or at best difficult to combine with other data. With a single collection agency the sampling techniques are now standardized and coverage is more appropriately distributed.

Observer deployment strategy is determined by four factors. In order of importance they are: fleet surveillance needs, the acquisition of catch and effort data, attainment of representative biological samples from the offshore sector and collection of other biological and technological data. Deploying observers to cover surveillance needs is largely a random process with the general aim of obtaining roughly equal coverage per stock except in special cases where surveillance requirements are greater. This strategy fits in very well with the sampling needs.

The attainment of representative samples from commercial catches is somewhat of an art and is a particularly difficult process when the populations and their parameters are unevenly distributed, and always changing. Fish populations exhibit annual and other cycles. but with many anomalies. This biological pattern affects the work of anyone studying living populations. The job of the observer is further complicated because he/she is working alone on a constantly moving platform where the primary aim of the vessel is to catch and process fish and where little emphasis is placed on estimating and understanding fish population parameters. The observer must thoroughly understand the concept of random sampling and apply it by using a series of techniques outlined in this manual to yield data representative of the catch. Also, each vessel presents a unique set of logistical problems which must be overcome in order to obtain valid samples.

TECHNIQUES OF SAMPLING

A more complete discussion of the theory of sampling and details of sampling methodology can be found in Gulland (1966). The following section concentrates on practical aspects of sampling at sea. It is essential to be as thorough and precise as possible when extracting and measuring fish from the catch. As a first step, assess the vessel layout and processing system to determine the optimum sampling procedure. In consultation with the vessel's captain or processing foreman, a sampling station can be selected such that fish can be randomly removed from the catch with minimum interference to the production operation. Culling by the crew can be quite a subtle procedure, therefore the operation must be studied carefully and a strategy worked out to eliminate logistical problems which could adversely affect the samples. The ideal location for sampling is close to the hopper shutes where the fish emerge into the processing area before they are handled. An additional advantage of such a site is that catch composition and discarding can be observed in conjunction with sample acquisition.

Careful choice of sampling site is important to ensure that samples obtained are representative of the catch. For example, the shape (relative sizes of fish) of the sample frequency of a particular species should be the same as the shape of the length frequency distribution of the total catch of that species. The crew will often separate size groups of fish for the purpose of differential processing, therefore, samples must be obtained prior to separation. Any samples taken from the size selected groups would not be representative of the population of the catch. Similarly, if fish for a sample are selected from only one area of the holding bin, it may be missing a certain size range found in the catch. In order to overcome this problem, a randomizing technique can be used in the selection of baskets (usually about 5 to 8) so that fish are removed before crew contact. This is accomplished by selecting baskets of fish at various intervals during the processing period.

The following excerpt is a modified version of sampling described in an early version of the the American Observer Program manual (unpublished) and may help to define random sampling more clearly:

> The basic method to be used when sampling length frequency distribution is the simple random sample, that is, every individual in the population (the catch in this case) has an equal chance of being selected. This would involve taking enough fish randomly so that more than (250) fish are taken of that species being sampled. In any type of random sampling, certain forces work against the achievement of a true random sample. There exists a subconscious tendency to select larger or otherwise obvious individuals. In addition, fish within a pile or in a trawl may stratify according to girth or size, further decreasing the chance of obtaining a true representation of the population in the sample. The effects of these tendencies may be reduced by selecting a number of smaller subsamples from the various locations within the pile to be sampled, and by taking every individual at these locations.

Care in sample selection is particularly important on Canadian vessels where the fish are dumped directly into a holding area in the processing room and within minutes are being handled and sorted by the crew. On Canadian vessels, to obtain length data representative of the catch immediate sample selection is essential. This is accomplished by removing fish from the processing room storage area before the crew starts to move fish to the cutting boards. Time will be restricted but it is important to remove the sample from various places in the holding bin to ensure that a representative sample is selected. On certain vessels such as side trawlers, the sampling may have to be done on the trawl deck but the above procedures would still apply.

Only about 20% of all sets occurring during the trip are sampled, therefore, those chosen must be representative of time and area fished. Radical differences in length and age distributions can exist between areas and in day and night catches. Judgement plays a large role in sample selection from commercial catches. By following the general procedures noted above and adapting them to each circumstance, representative samples will be obtained.

Three types of samples can be extracted from catches at sea; catch, landing, and discard. This contrasts with shore plant sampling where only landing samples can be obtained. Frequencies from unculled catches (catch samples) are the most useful form of length data because they are representative of the total removals including discards. A landing sample would represent that part of the catch remaining after discarding takes place (if no discarding occurs then landing samples are equivalent to catch samples). Landings are the fish that are kept and processed after discarding, hence, a landing frequency may not be a good indicator of the size composition of a species in the catch where discarding has occurred. The discard sample is composed of whole fish that are to be dumped overboard. This portion of the catch normally comprises small or otherwise unmarketable fish which are not kept. The ideal strategy where discarding occurs is to obtain both a catch sample and discard sample. This would enable an estimate of the size composition in the catch of the species being sampled and yield information on the discarded portion. In most fisheries, however, landing frequencies approximate catch frequencies because discarding is minimal.

Figure 5 illustrates a typical processing room layout that might be found on board a foreign vessel, with potential sampling points. The sampling site should be spacious enough to set up sampling equipment and with the catch easily accessible. A sample size of 200 to 300 fish is optimum and must be sampled according to standard procedures summarized in Table 2. This table lists for all major commercial species, codes, methods of measurement (i.e. total length, fork length, etc.), length group to be used (1 cm intervals, 2 cm intervals, 3 cm intervals, etc.) and indicates whether the species should be sexed. Length frequencies are kept separate by sex for species where males and females grow at significantly different rates and where sex ratios vary. When catches contain sufficient amounts of two commercial species, it may be possible to sample both.

The following steps can then be used to produce the sample record. Determine total weight of selected fish, in kilograms. When using a hanging balance in a heavy swell, allow the dial to swing back and forth several times in order to determine the midpoint of the dial movement to insure that as accurate a value as possible will be read. Insure that the scale is well maintained as it can deteriorate rapidly in the salty, moist environment of the processing room. Next, place each fish on its side on the scaled measuring board (ventral side down for flatfish) with the tip of the snout touching the head of the board. The value inscribed between marks on the measuring strip where the end of the tail rests signifies the length in cm (Table 2 lists the appropriate body length measurements for each species.).

Recording of data can be done in several ways but the final result must be coded on the length frequency sheet. Attached to some of the sampling boards are demarcated white strips useful for recording lengths in a one person operation. By marking length group tallies onto the strips, handling of a clipboard with tally sheet under wet conditions can be avoided. Also, solid plastic frequency recording boards are useful under particularly wet conditions.

The next step, if required, is to determine the sex of each fish. Figure 12 and 13 display a series of drawings of dissected fish to assist in differentiating the sexes of the various commercial species. Care must be taken in locating them in the mesentary (tissue flap) attaching the intestines to the dorsal portion of the gut cavity. Flatfish gonad location and configuration as illustrated in Fig. 13 are different from round fish species.

Once sex has been determined, the length for each fish can be recorded on the tally sheet in the appropriate columns. If the species is not sexed, tallies are made in the left column. Figure 14 illustrates how the tally sheet for groundfish species is completed. Witch is the illustrated species. Each crossed set of tally marks represent five fish that have been measured. The length grouping for witch (and all other flatfish) is 2 cm, that is, every 2 cm of measured fish length are grouped together as one category. For example, if the flatfish being measured is 45 cm long, it would fall into the 44-45 cm length group.

For ageing purposes, bony white structures called otoliths (ear bones) are removed from the otic capsules of skulls for a stratified subsample of the fish being measured. A stratum is an assemblage of the population elements of non-overlapping groups in which the variation among individuals within a group is less than that among individuals in the population as a whole. The stratum, in this case, is all individuals in a particular size group from which a subsample of fish are to be selected for otolith removal. In the example of witch measurements (Fig. 14), the first fish in each 2 cm length category (by sex) in the sample would have its otoliths removed and placed in a labelled envelope if one fish per stratum were to be sampled for age. Otolith envelopes should be completed with the actual length of the fish recorded. Otoliths from this fish would then represent that length group with respect to age.

Each species is treated differently during sampling but the general procedures outlined above and information from Table 2 can act as a guide. The following section summarizes particular sampling procedures for each of the major commercial species. The basic units used when determining distribution of sampling intensity is the stock (Appendix 1 lists the various stocks by species). Specific sampling requirements are outlined prior to the start of each trip.

Cod (Gadus morhua)

Length Group: 3 cm

Length: Cod are measured from the tip of the snout to the fork of the tail

Sex: No

Otoliths: Otoliths are taken by cutting down at an angle behind the eyes. On very large cod, where the skull is too hard to cut with a knife, insert the tip of the blade into the middle of the skull behind the eyes and pull from side to side. This will crack the skull providing access to the otoliths. Another method is to cut through bulges in the skull (otic capsules) located underneath the head in the gill area. This method allows for easier access to otoliths in very large fish.

Redfish (Sebastes marinus, S. mentella or S. fasciatus)

The three species of redfish noted above are found in Canadian Atlantic waters. For the purpose of set observation and sampling, only the former two will be differentiated since the third, fasciatus is almost identical in appearance to mentella. S. mentella is the dominant species in most regions. Key characteristics for identification are a sharp bony projection on the front of the lower jaw, bright red color and proportionately large eyes. S. marinus is somewhat more orange in color, has a small or almost non-existent bony projection on the jaw and the eye is relatively small. Before sampling, separate the two species and discard any S. marinus. Only S. mentella samples are normally required.

Length Group: 1 cm

Length: Redfish are measured from the tip of the snout to the end of the shortest rays of the tail located at the fork.

Sex: Redfish exhibit sexual dimorphism in growth, therefore, must be sexed. To locate the gonads open the gut cavity by a cut from the anus to the throat. The paired gonads are located in the dorsal and posterior part of the cavity near the back bone and are imbedded in transparent mesentary tissue. The male gonad is grey-white in color, narrow, elongated and has sharp edges while the female gonad is more rounded, shorter, darker colored, pliant, and has no sharp edges. Small eggs can be seen inside the maturing female gonad.

Otoliths: Otoliths can be extracted by cutting down at a 45° angle through the skull just behind the eyes. The otic capsules containing the otoliths are located directly behind and to the sides of the brain.

Flatfish

This section refers to the commercial species of pleuronectids, turbot (*Reinhardtius hippoglossoides*), witch (*Glyptocephalus cynoglossus*), halibut (*Hippoglossus hippoglossus*), yellowtail (*Limanda ferruginea*) and plaice (*Hippoglossoides platessoides*). All flatfish must be sampled by species. For identification, refer to the diagrams in the species identification handout or Liem and Scott (1966).

Length Group: 2 cm

Length: Flatfish are measured from the tip of the snout to the end of the longest rays of the tail. Except for turbot and Atlantic halibut which are measured by fork length.

Sex: Flatfish males and females grow at different rates, therefore, they must be sexually differentiated. Gonads of all species are similar in appearance (Fig. 12 and 13). The female gonad is triangular, soft and is elongated posteriorly, more so in mature individuals. The color is often red or pink. The male gonad is usually white, firm, and generally smaller than the female. It is produced laterally rather than posteriorly.

Otoliths: Otolith extraction may be required for some flatfish species. Cut vertically, not at an angle directly behind the eyes on the lateral ridge on the head. The otoliths are located directly behind the brain. Because flatfish skulls are twisted, the otoliths will be found one over the other rather than side by side as in other species. Special care should be taken when removing the very thin, brittle turbot otoliths.

Grenadiers

Three species of grenadier commonly occur in the northwest Atlantic and are abundant at depths greater than 500 m; roughhead, roundnose (the dominant species), and common. Before sampling, separate the species using Liem and Scott (1966) or refer to the species identiication handout. Normally only the roundnose grenadier require sampling.

Length Group: ½ cm

Length: Grenadiers are measured from the tip of the snout to the front of the anal fin (anal fin length). Grenadiers have very fragile tails that are frequently broken off, therefore, use of total length is inappropriate. Refer to Fig. 15 for measuring instructions and Fig. 16 for an example of the grenadier length frequency sheet. Details on filling out the header of this sheet are given in the section, Coding Length Frequency Sheets.

Sex: Determination of sex for these species is difficult because commercial catches contain mainly immature fish. Mature individuals tend to migrate to oceanic depths. Generally, the male gonads are grey-white in color, small, narrow, somewhat flattened, elongated and are firmer than those of the female. Female gonads are often larger than the male gonad, more rounded, short and soft. The colour is also somewhat darker than for the male but as in immature individuals of all spcies colour is not a reliable indicator of sex. Gonads of both sexes may be only 1-2 cm long in the most immature specimens making identification very tedious. The position of the gonad is similar to redfish. Otoliths: Otolith samples are not normally required for grenadiers but when required cut at an angle behind the eyes as shown in Fig. 15.

Capelin (*Mallotus villosus*)

Capelin from the Div. 2+3K stock located on the Labrador Shelf are not measured at sea by observers. Instead, frozen samples consisting of 200 whole fish are returned to the lab for detailed examination. Freeze each sample in a plastic bag with an enclosed identification tag and tied off with an additional tag. On both tags, the following information must be printed in pencil: Place caught (latitude and longitude), date of the set, type of gear used to catch the fish, vessel's name, trip number, set number and year.

The selection of the sample is to be as random as possible, with a total of two samples per week, per area, per gear required. Sampling at sea for the 3LNO Grand Bank stock may be required For this, special instructions will be given during the briefing session.

Squid (*Illex illecebrosus*)

Detailed descriptions of species of cephalopods can be found in Anon (1977) and Roper et al. (1979). The only commercial variety in Canadian waters is *I. illecebrosus.*

Length Group: 0.5 cm

Length: Measure squid from the tip of tail fin to the anterior dorsal protuberance.

Sex: Females may be distinguished by the presence of two oviducal glands and oviducts, one on either side of the stomach. Late in the season, the presence of nidamental glands in females is also a key feature. Only one gland is present in the male, the spermatophoric gland, located on the animal's left side.

Otoliths: Squid do not have otoliths.

Maturity: Normally maturity stages need not be recorded by observers. However, when required, only the males need be classified according to maturity. Almost all females are immature during the fishing season and should be referred to as Stage 1. The most mature animals should be frozen and returned to the lab.

The maturity stages for squid are:

1. Immature. The spermatophoric organ is thin and transparent or with a thin mid-lateral streak. The vas deferens is thin and transparent and the spermatophoric sac is empty.

2. Maturing. The spermatophoric organ has a white mid-lateral streak. The vas deferens is thick and white and the spermatophoric sac may contain some whitish particles.

3. Mature. The spermatophoric sac contains spermatophores becoming white, thick, and full at stage 3.

4. Spent. After copulation the spermatophoric sac is empty and flaccid. For more information on sampling and illustrations of dissected squid, refer to Amaratunga and Durward (1978). The four stages described above are presented photographically in this publication. Further instructions using dissected squid will be given during the briefing.

Shrimp (*Pandalus borealis* and *P. montagui*)

The shrimp fishery, with somewhat different characteristics from groundfish fisheries, requires a more detailed sampling scheme as described below. Carapace lengths of shrimp are taken to the nearest half millimetre. Vernier caliper readings are exemplified as follows: 0.0 to 0.49 is 0.0.

i.e.	Dial	0.0		0.5		1.0		1.5		2.0
	Reading		0.0		0.5		1.0		1.5	

Measured samples of shrimp must be randomly selected. To avoid collecting shrimp that have been graded do not select samples from the various processing sorters which separate the catch into medium and large components, rather obtain samples directly from the unsorted catch. Each measurement must include 250 to 300 shrimp. Weigh the sample accurately making sure excess water, broken and unmeasurable soft-shelled animals are removed. Figure 17 shows how the frequency sheet should be recorded. The ovigerous category refers to those shrimp carrying eggs externally on the abdomen (tail).

At least two samples should be taken each 24 hour period, selected at different times of day and night to ensure that measurements are representative over the diurnal cycle. Arrange for one of the crew to set aside a sample from sets which occur during hours of rest. Shrimp is the priority species but length frequencies of various bycatch species are required as well. A concentrated effort should be made to sample bycatch in detail because substantial numbers of juvenile redfish and turbot are taken as incidental catch. Sampling bycatch may preclude obtaining the shrimp measurement for that set or the shrimp sample can be set aside to be completed later.

Some vessels, particularly those with sorting machines on board, regularly discard various amounts of broken and undersized shrimp. Record the weight of these discards and at convenient intervals take measurements of the discarded shrimp. Use the standard procedure of randomization for these samples as well.

Gear type and size can affect catch composition and shrimp size composition. For each set, it is important to know the specific type of net used and its dimensions ie., Sputnik 1800 43/51 or Kalut 1800 53/61 (the numbers 43/51, and 53/61 denote the length of the headline and footrope). Some vessels alternate the net used from set to set and this should be noted on the set detail sheets as well as the frequency. Appendix 3 provides codes for all gear types.

Figure 18 shows the position of the Labrador shrimp stocks. The major species from these three areas and Davis Strait is *Pandalus borealis*. *P. montaqui* is the dominant species only in Ungava Bay. In addition to the two commercial species noted above, small amounts of bycatch shrimp species are taken. Their proportions should be noted. For the identification of less common species refer to Butler (1980), Smaldon (1979) or Squires (1970).

Large Pelagics: (swordfish, tunas, sharks)

The major commercial species in the Canadian zone are porbeagle (*Lamna nasus*), mako (*Isurus oxyrinchus*) and blue (*Prionace glauca*) sharks, as well as swordfish (*Xiphias gladius*), yellowfin (*Thunnus albacares*), blue fin (*Thunnus thynnus*) and big eye (*Thunnus obesus*) tunas.

Large pelagic fisheries are usually executed using longlines with baited hooks which are set and taken back after a 24-hour period (refer to the section, Longliners, for a detail description of the use of this type of gear). Because the numbers of individual fish taken per set are relatively low (and each specimen is large) it is possible to record weights and lengths of all individuals that come onboard. In filling out the set and catch details follow the procedures listed under the section, Longliners.

Sampling procedures are as follows. Each fish will be weighed and sexed with the following four measurements done to the nearest cm. fork length, flank length, ½ girth and ½ of maximum depth as illustrated in Fig. 19. The large pelagic length record sheet is illustrated in Fig. 20. When possible, bring back frozen whole specimens for detailed lab analysis particularly for tunas or swordfishes or if this is impossible, return frozen heads of specimens that have been sexed, weighed, and measured.

SAMPLING REQUIREMENTS SUMMARY

Specific sampling instructions for target species, whether directed or bycatch, are given during the briefing session. Normally a minimum sample of 250 fish of the directed species per day fished is required. The following section need be referenced only if written briefing instructions are not available for a particular species caught. In cases where this listing contradicts the briefing instructions, follow the written briefing instructions.

The following sampling summary requirements are for groundfish species only. For special trips such as herring, capelin or silver hake, supplemental instructions will be given at the time of briefing. Table 2 illustrates details of sampling, by species.

Gadoids (Cod, Haddock, White Hake)

Measurements - Take all possible unsexed measurements in all areas (fork length, 3 cm group).

Otoliths - Collect otoliths for each gear type, each Division, each quarter. Briefing instructions will include numbers required on a particular trip.

Flatfish

Turbot - Collect sexed measurements with no otoliths from foreign vessels only directing for turbot.

Witch Flounder, 2J3KL and 3NO - Collect sexed length frequencies with no otoliths from foreign vessels directing for witch.

American Plaice - Collect sexed measurements of discarded fish from Canadian vessels in all areas. No otoliths are required.

Yellowtail - Apply the same instructions as given for American plaice.

Redfish

Collect as many length frequencies as possible in all areas and all countries, but only from the directed fishery. Otoliths are to be collected in 3M, 3L, 3N, 3O only, one set per strata per sample. *S. mentella* only should be sampled.

Roundnose Grenadiers

Measure as many fish as possible from countries with allocations. No otoliths are required.

Blue Hake

All blue hake which come on board are to be measured. Otoliths are not required. This applies to all countries, all areas. Frozen samples returned to the lab may also be required from time to time.

For all other species such as squid, shrimp, and large pelagics, refer to the specific sections in the manual for details on sampling requirements.

CODING LENGTH FREQUENCY SHEETS

The top section of the length frequency sheet is used to record detailed information for the sampled set. Four standard frequency types are described in the following section.

Groundfish

Once the tally portion of the frequency sheet is completed (Fig. 14), the top section should be filled in. Refer to Appendix 3, Part 2 for a complete listing of codes.

Set No.: Four spaces are available for set number. Determine which set the sample was extracted from and place this number in the space. Following the example referred to in earlier sections, the header for the sample of witch from Set 26 would be coded as 2 6 . Always right justify, leaving spaces to the left as blanks.

Country Quota: This category refers to the country whose quota is being fished. Appendix 3, indicates that USSR is coded as 20, therefore, the record would read 2 0 .

Species: Using the species code listing, fill in the three digit species code for witch as 8 9 0 .

Sex: There are two levels for this category, with the top space labelled M for males and the bottom space labelled F for females. If unsexed, leave this category blank. If the frequency is from a sexed sample, then place a 1 in the top space beside M and a 5 in the bottom space beside F.

Trip No: The example is from trip 83 and therefore would be coded as 8 3 . Where appropriate the frequency header and the set sheet for the same set must match.

Vessel Side No.: If the side number of the vessel is MB45172 as in the example then code as M B 4 5 1 7 2 (right justified).

Tonnage: For a vessel tonnage of 2,200 GRT code as 7 , signifying the tonnage class code for ships greater than 2,000 GRT. Refer to the Appendix 3 for a complete list of tonnage class codes.

Gear Type: The vessel in the example is a stern trawler utilizing an otter trawl. This gear would be coded as 1 and would be right justified. Refer to Appendix 3 for a complete list of gear codes.

Mesh Size: Mesh size already measured, will be recorded on the corresponding set sheet (Fig. 10). Simply transpose that value into the three spaces provided. Mesh size on the frequency sheet refers to the codend mesh size (in cm) and in the example, 120 cm would be recorded as 1 2 0 .

NAFO Division: Using the starting position, determine the NAFO Division fished. Rather than the numerical coding used on the set sheet, write in the actual NAFO Division. For example, if the set occurred in 3Pn, code as 3 P n . In the current example, with a starting position in 3L, code as 3 L . For areas with only 2 digits leave the space to the right blank. Note: This category is the only one that is left justified.

Unit Area: Using the starting position of the set, match it to a unit area on the NAFO map (Fig. 11). In the example, unit area 326 would be where the set occurred. Dropping the first digit, code in the last two as 26 (the first digit signifying Subarea 3 can be dropped since it is already specified in the Division category).

Latitude: Record degrees and minutes at the start of the set in this slot. Note that on foreign vessels, position, time, and depth information can be obtained from the International Fishing Log. Following the example, the latitude 47°40'N is coded as as 4 7 4 0 . Do not record seconds and do not write in degree and minute indicators.

Longitude: As above, starting longitude of the set is recorded in this slot. Following the example, the longitude is 48°25'W and is coded into the four spaces as 4 8 2 5 .

Time: Record the starting time of the set in GMT using the 24 hr clock. In the example, fishing started at 4:00 in the afternoon GMT and would be coded 1 6 0 0 .

Use: Use refers to the type of sample obtained.

i) C (catch) - This refers to a sample of the catch taken before it is sorted in any way. It would be representative of exactly what comes up in the net.

ii) D (discard) - This refers to fish that are sorted from the catch and then discarded overboard. This group usually consists of small individuals that are difficult to process or have no commercial value. If whole fish go into meal they are not considered discards but rather part of landings.

iii) L (landings) - These consist of the fish remaining after discarding. They are processed and stored in the hold. If there is no discarding in a set then the fish will be regarded as catch (coded as C), not as landings.

As a general rule, where no discarding occurs C will be used. If discarding does occur, determine whether the measured fish have been culled and record as L if they have. In some cases, discard samples may be required and would be recorded as D.

Year: Place the year in which the fishing occurred in two spaces provided. In the example, fishing took place in 1984 and is coded as 8 4 .

Month: Place the numerical designation for month in the two spaces provided as JAN = 1 FEB = 2, etc. Fishing that took place in May would be coded as 5 .

Day: Place the numerical value for the day on which the fishing occurred in the two spaces provided. Always code the day on which the set commenced even though it may run into the next day. In the example, the set starting on May 26th would be coded as 2 6 .

Quarter: Determine the quarter of the year in which the fishing took place. In the example, May falls in the second quarter and would be coded as 2 .

Port Country: This category refers to the flag state (country of Registration) of the vessel. Use the appropriate country code from the list of codes in Appendix 3 under the category country quota.

Depth: Record average depth of the set (depth at which most of the fishing took place), in metres. Following the example, average depth of 535 m is coded as 5 3 5 .

Species Total Weight: The value to be recorded will depend on the disposition of the fish. This is specified in the category 'Use', described above. If 'Use' is specified as C, then species total weight will be recorded as 'kept weight' plus 'discard weight' of the sampled species (i.e total catch weight of the sampled species for that set). If 'Use' is coded as L (landing), then species total weight will be recorded as the 'kept weight' only of that species. If 'Use' is D (discard) , the species total weight will be recorded as the 'discard weight' of the species sampled for that set.

Sample Weight: Total up the weight of all baskets of fish (minus the basket weight) in the sample. If $19^2/_5$ baskets of fish at 25 kg each were weighed for a total weight of 485 kg, then recorded as 4 8 5 .

No. Otoliths: This provides a record of number of pairs of otoliths removed from fish in the sample. If there are 20 length groups in the male frequency and 24 length groups in the female frequency with one pair of otoliths per length group removed, then the record for M(males) and F(females) is 2 0 and 2 4 , respectively (right justified).

Length Grouping: Table 2 lists all the major commercial species (to be sampled), their codes, and the sampling techniques to be used. For flatfish the length grouping is 2, that is, lengths are grouped by 2 cm intervals. In the example, witch would be coded as 2 .

Collector: Write in the name of the sampler.

No. in Sample: Add the numbers of males and females measured and enter this total in the space provided.

Vessel: Record the name of the vessel.

Country: Record the flag state of the vessel (country of registration as specified on the license).

With all the above categories filled and tallies of length recorded, the frequency is complete. It is a good policy to check each sheet right after completion, then again at the end of the trip to ensure that there are no mistakes.

Grenadier

The format of the grenadier sheet is quite different from that of the general groundfish frequency, therefore, it is necessary to list a separate set of instructions for this sheet. Refer to Fig. 16 as an example of a completed record.

Vessel: Place the code 9 9 signifying a commercial vessel in the right side of the box and print the name of the vessel on the left side. A full description of codes can be found in Appendix 4.

Cruise: Fill in the trip number as assigned, 5 8 in the example.

Stratum: Leave this category blank.

Set: Write in the number of the set from which the fish were taken.

Day: Write in the date on which the set commenced. In the example, Nov. 24th would be coded as 2 4 .

Month: Place the number of the month in the space provided. In the example, November would be coded as 1 1 .

Year: Place the last two digits of the year in the space provided. In the example, 1984 is recorded as 8 4 .

Division: Code in the NAFO division (Fig. 11) in which the fishing occurred. For example, if the fishing took place in 3K record 3 K in the space provided.

Type Experiment: Leave this category blank.

Species: Record the appropriate 3-digit code for the species being sampled. A full list of codes can be found in Akenhead and LeGrow (1981).

Number Measured: Leave this category blank.

Ratio: Leave this category blank.

Sex: Leave this category blank.

Gear: Record OT if the gear used was a bottom trawl and MT if the gear was a midwater trawl. These are the only two types of gear used for the grenadier fishery, the former being the most common.

Day-Night: Record the starting time of the set in the space to the left and the finish time in the space to the right (in GMT).

Grouping: Always place a 5 in this space to indicate that the fish are measured by 5 mm (1/2 cm) groupings.

Collector: Write in the collector's name.

Weight: In the upper portion of the last space to the right, record the sample weight in kg and in the lower area record the species total catch weight for that set. In the example, 230/4650 would signify a sample weight of 230 kg and a roundnose grenadier total catch weight of 4650 kg for that set.

Total: At the bottom of this form record separately the total number of males and females measured for the sample and record the grand total.

Shrimp

In conjunction with the tally portion of the shrimp frequency form, complete the header as follows (refer to Fig. 17 as a guide):

Card No.: Leave this category blank.

Frequency No.: Leave this category blank.

Species: Code the actual species sampled. Only two species Pandalus borealis (8111) and P. montagui (8112) are to be sampled.

Vessel: Vessel code is based on tonnage and is coded accordingly. In the example, the vessel's GRT is 600, therefore, this category would be coded as 5 . See Appendix 3 for a list of tonnage class codes.

Country: Country codes for the shrimp frequency differ from those used on other forms. They are listed in Table 3 of Appendix 3.

Trip No.: Record the trip number assigned. Trip 79 in the example is recorded as 79.

Set No.: Record the set number from which the sample was taken. Set 87 in the example is recorded as 87.

Year: If the sample was done in 1984, then record 84.

Month: Months are coded 1 through 12. In the example, July is recorded as as 7.

Day: This refers to actual calendar day on which the set started. In the example, July 23rd is recorded as 23.

Time NST: This category refers to midpoint of tow and should be recorded in Newfoundland Standard Time and not in GMT as on other forms (i.e., midpoint in GMT - 3.5 hr. = midpoint in NST). In the example, a set starting at 1800 GMT and ending at 2000 GMT would be recorded as 1530.

Latitude: Record the start latitude of the set. The latitude 56°10'00" would be recorded in decimal seconds as 56 10.0.

Longitude: Record the start longitude of set, as above.

Duration: Duration of the set should be recorded in minutes. For example, a set duration of 3 hrs. and 30 minutes is written as 210.

Bottom Type: Leave this category blank.

Depth: Record average depth to the nearest metre.

Temperature: Leave this category blank.

Stock Area: Code specific areas fished as follows:

0 + 1	10	Trinity Bay	100
1A	11	Conception Bay	110
1B	12	St. Mary's Bay	120
1C	13	Placentia Bay	130
1D	14	Fortune Bay	140
1E	15	Ramea East (Hermitage Bay)	150
1F	16	Ramea West (Burgeo Bank)	160
0A	20	Banquereau	170
0B	30	Southern Gulf	180
Ungava Bay, S. of 61°	40	West of Anticosti Island	190
Hudson Strait, N of 61°	41	Mingan Channel	200
2G	50	Esquiman Channel (south of 50°)	210
Hopedale Channel (2H)	60		
Cartwright Channel (2J)	70	Esquiman Channel (south of 50°)	220
Hawke Channel (2J)	80		
Funk Island Deep	90		

Fig. 18 illustrates some of the offshore stock areas. The above set of codes are unique to this form and should not be used elsewhere.

Unit Area: Refer to Fig. 11 and code in unit area. In the example, 212 signifies that the set commenced in unit area 212.

Stratum: Leave this category blank.

Gear: Code as follows:

#36 shrimp	2
Iver Christensen (shrimp)	4
Kalut	13
Sputnik unspecified	15
Sputnik 1600	19
Sputnik 1800	20
Sputnik 2000	21

The above set of gear codes are unique to this form and should not be used elsewhere. In the example, the Sputnik 1800 used would be recorded as 20.

Catch: Record catch of the sampled species for that set to the nearest kilogram. The value will depend on type of sample. If it is a commercial sample (catch), then the total species weight would be recorded (kept and discards). If the sample is from discards, then only the discard weight of the species would be recorded. In the example, the catch weight, 3700 kg, would be recorded as 3700.

Ratio: Ratio is obtained by dividing the value recorded in the category "catch" by the weight of the sample.

Example: $\frac{\text{Total catch}}{\text{Sample weight}}$

$$= \frac{3700 \text{ kg}}{4.2 \text{ kg}} = 881.0 \text{ (to one decimal place)}$$

This value would be recorded as 881.0.

Sample Type: Signifies type of sample obtained. Research (catch): Coded as 1 refers to a random sample of the total catch from a vessel involved in research. Commercial (catch): Coded as 2 refers to a random sample of the total catch from a vessel involved in a Commercial fishery. Discard refers to a random sample of the discards from a vessel involved in a commercial fishery.

Condition: If the sample contains ovigerous (eggs carried externally on the abdomen) and nonovigerous animals code as ½. Code as 1 if it contains only nonovigerous animals, and 2 if it contains ovigerous animals only.

Collector: Record observer's name.

Sample Weight: Record total weight of shrimp in the sample, to the nearest 1/10 of a kilogram (subtract weight of the bucket used to hold the sample). In the example, a sample weight of 4.15 kg would be recorded as 4.2.

SST (Soft Shell Tally): This is a tally of all shrimp in the sample with shells too soft to be measured. SST shrimp should not be tallied in the frequency, nor should they be included in the sample weight. In the example, no SST shrimp were found.

As with all other forms, the data should be checked carefully for errors upon completion.

Large Pelagics

The header on the large pelagics length frequency sheet is nearly identical to that of the groundfish frequency. Refer to the groundfish frequency instructions and Appendix 3 Table 2 for codes. Figure 19 illustrates the four types of measurements done for each fish and Fig. 20 shows how this morphometric data should be recorded. All values are rounded to the nearest kg.

OBSERVING AND SAMPLING - SPECIAL CASES

The preceding sections outline how to perform observations of catches, fill out the set and catch sheet and sample and record on the frequency sheet for various commercial species. The example of a USSR stern trawler directing for redfish was used for set and catch, however, many different situations will arise during the various deployments (gears, areas, species). The same basic techniques can be applied, with adjustments to fit the particular situation. Judgement, adaptability and this manual are key tools of the job. In the following section, highlights of special types of deployments are given and outlines of the measures required to obtain the data are specified.

Canadian Vessels

Observing sets, collecting catch data and sampling are often more difficult on domestic vessels than on foreign vessels. Determination of detailed set breakdowns is a problem because the catches are dumped directly below deck through a large stern hatch into an irregularly shaped holding bin enclosed by checkers at the lower end. This causes problems in obtaining volumetric estimates of catch because of the irregularly shaped holding bin and confined working area. In certain cases, volume of the holding area can be derived by drawing a diagram, measuring all the dimensions and then breaking the diagram down into geometric subsections. The volumes calculated for each of the subsections can then be added. However, for preliminary catch estimations, the observer may have to depend more on bag size estimate as the catch comes on board and less on volumetric bin estimates where holding area shapes are very irregular.

The most important method of determining weight of the major species on Canadian vessels is from volumetric estimates of iced fish. The captain or mate can be very helpful in this regard because they are normally very knowledgeable about storage hold volumes. By knowing the volume of iced, gutted fish in the hold, an estimate of round weight can be made using the appropriate conversion factor. Measure the various ice holds and determine how much they are filled each day (this factor must account for ice volume).

A different approach is required for discarded species. Direct weighing of fish to be discarded is obviously the most accurate method and is to be used whenever possible; however, this is not often practical, particularly where catches and amount of discards are large. Alternatively, tallies of discarded fish can be obtained by observing the number of fish, by species, going into the discard shutes. Where more than one shute exists, and this is most often the case, observe each shute for a set period of time during the discarding process. The amount of time spent on each shute should depend on size of catch and processing time. If, for example, four discard shutes were used for a particular set, the numbers of each species tallied would be averaged over the four shutes, converted to weights and adjusted to total time discarding occurred. The following illustrates the calculation required if total processing time was 4 hrs (240 min), average time spent observing each shute was 20 min and 50 fish or 100 kg of cod, was the average amount discarded down each shute (80 min of observations out of 240 of processing, 20 min per shute):

$$\text{Estimated discarded cod} = \frac{240\ \text{min} \times 100\ \text{kg}}{20\ \text{min}} = 1200\ \text{kg or } 1.2\ \text{t}$$

Sampling is also more difficult on Canadian vessels because the catch is dumped directly below deck and is processed very quickly by the crew. To avoid an improperly selected sample, be prepared to take the fish as it comes down into the holding area. Remove the sample from the catch as quickly as possible, before the crew culls the fish. Do not remove fish after the crew have started sorting because it is possible that either all large or all small ones will be picked first and this could result in an unrepresentative sample. Landing samples should be taken from the conveyor belts after discards have been removed by the crew.

Spanish Pair Trawlers

Usually only one observer will be assigned per pair on Spanish pair trawlers. Under these circumstances, detailed observations can be done for only one ship. It is, however, essential to collect set details and catch figures from the log for sets taken on board the sister vessel. These data can be collected by contacting the other vessel by radio. It is also useful to observe the sets going to the other vessel through binoculars to verify the log figures given. The pairs alternate processing of catches, therefore, the observer is able to directly observe only 50% of the sets which usually involves only 1 or 2 sets per day. Extra time can be spent estimating amounts of discards because these types of vessels usually discard all bycatch along with some of the main species when catches are large. It is easier to have the discards put aside than on the Canadian vessels, therefore, direct weighing of discards can be done.

In the case where two observers are placed on a pair (one on each vessel), it is treated as one trip. Both observers would use the same trip number and would alternate set numbers. It is also necessary for the side number of only one ship to be recorded because side number identifies effort in days fished. If two side numbers are used on a particular day (one or more sets to each boat) this would be interpreted incorrectly as two vessels fishing, one day each.

Catcher-Processor Fleet

GDR (East Germany) utilizes a catcher-processor fleet consisting of the smaller OT5 (500-999.5 GRT) vessels for catching the fish and larger OT7 (2000+GRT) vessels to process the catches. After a set has been completed, the crew members of the catcher cut away the codend, attach floats and a marker, and release it into the water. The processor immediately intercepts it and puts it through production. Generally, there are about 10 catchers and one or two processors. It is most efficient to utilize a team of observers in this situation with the two or three leaders stationed on the processors. See Fig. 21 for a diagramatic representation of the catcher-processor operation.

Singly deployed observers on board the catchers are responsible for collecting sets details only because the codends do not normally come on board these vessels and therefore, estimates of catch composition and weights cannot be done. This effort information collected by the catcher must then be matched with catch estimates for each set collected by the team leaders on the processors. The observer on the catcher is, therefore, responsible for recording the set data on the set and catch sheet but with catch details left blank. Conversely, the team leaders on board the processor are responsible for collecting catch details (catch weight by species) for bags coming from catchers carrying an observer. The set sheets would not be available to the team on the processors at this time, therefore, the data must be recorded on a special form illustrated in Fig. 22. It allows for catch records of up to four bags. More than one form per day will be needed for larger catcher fleets. These data can then be matched and transferred to the appropriate set and catch sheets at the completion of the trip.

Several codends are sometimes combined into one hold on the processor. In this case specific sets cannot be separated by the processor team and the resulting calculations of catch composition must be averaged values for those combined sets. However, total weights of each of those sets can be estimated separately from bag size observations before mixing takes place. In this way, estimated relative compositions must necessarily be the same for these combined sets but their total weights would differ. In addition, processor observers are responsible for sampling the catches and carrying out conversion factor observations in the regular manner.

Gillnetters

Gillnets are commonly used by Portugal to fish for cod, white hake and turbot. The manner in which these nets capture fish is quite different from the otter trawl, therefore, the methods used to collect and record catch and effort data from the two types of gear is not the same. The otter trawl operates in an active fashion, scooping up a portion of the fish in its path. In areas where fish are more abundant or concentrated, it will generally be reflected in higher catch rates. The amount caught per hour reflects to some extent relative abundance. By contrast, gillnets are passive, suspended in the water column and entrapping only the fish that swim into it. Catch per unit effort for this type of gear is probably a less reliable index of abundance. The manner and size of nets used for any particular operation can be quite different and this introduces further variability. For example, a varying number of nets can constitute a single unit of gear (refer to Kristjonsson (1959) and Nedelec (1975) for a full description of gillnet types). To overcome this problem, quantity of gear must be incorporated as part of the measure of effort, hence, an appropriate catch per unit effort for the gillnet operation is catch per thousand metres of net. Utilizing this measure of effort takes into account variability in amount of gear deployed during a particular operation. A time period is not included in this rate because offshore gillnets are generally hauled once every 24 hours and, therefore, time is standardized to one day. The effectiveness of the gear in capturing fish drops rapidly after about two days due to saturation and this makes it undesirable to leave gear in the water for long periods (fish quality is also substantially affected by long periods of entrapment). Slight modifications to the set record are necessary when the nets remains in the water for more than a day. These are outlined in a later section.

One set, therefore, is equivalent to one day of fishing and the method of filling out catch and effort sheets must reflect this. Under normal circumstances, one set and catch sheet will be used for each day fished. Several categories on the sheet must be filled in a unique manner.

Two systems of gillnet fishing are used offshore. The two types vary only in the manner in which the nets are set and hauled, the gear itself being basically the same. Under one system, small boats leave the mother ship, set their nets and then return to haul them later. The other system uses no small boats and the setting and hauling operations are done exclusively from the main ship. Because of the differences in the two systems, observations of discards and methods for estimating catch will vary. On vessels which use small boats to set and haul the nets, estimates of landed weight come from direct observation of the off-loading of the catch from the small boats to the mother ship. This occurs once or twice a day and these catch estimates are equivalent to bag size estimates for otter trawls. If possible, the hauling procedure should be viewed from one of the small boats to observe discarding. On vessels where nets are set and hauled from the main ship, the take back procedure is observed to obtain preliminary estimates of catch as well as bycatch and discards. In both cases, it is essential to utilize volumetric and converted product weight estimates in the final analysis of the catch, as done for other gear types.

The differences between gillnets and otter trawls noted above make it necessary to modify the catch record and these changes are outlined in the following section. Refer to Fig. 23, the set and catch sheet with modified categories, when filling in the following slots:

Gear Type: This category is coded as 05, signifying gillnets as the gear used.

Codend Mesh Size: This category is left blank.

Body Mesh Size: This category is used to record average mesh size, in mm., of the gillnets. In the small boat fishery, mesh measurements must be made from one of the dories when the nets are being hauled or set.

Roller Size: This category is left blank.

Chaffing Gear: This category is left blank.

Number of Gillnets: This category is used to record number of gillnets hauled for a set (usually the whole fleet of nets). Corresponding amounts of fish removed from those nets would be recorded on the reverse side of the set and catch record.

Number of Hooks: This category is left blank.

Net Damage: This category is normally recorded as 1, signifying no damage. If nets are tangled or destroyed in heavy seas, 3 would be recorded to signify gear damage which probably affected amount caught.

Vessel Tow Speed: This category is always coded as 0.0 because the gear is stationary when fishing.

Start Time: This category is recorded as 1 to signify the start of the day regardless of the time that the nets are actually set. This allows standardization of effort to one day.

Duration: This category is always recorded as 23.9 hours to signify one day of fishing. The fish removed from the hauled gear for that day would be recorded on the reverse of that set sheet.

Data Source: This category would be recorded as 1 to signify an observed set because fish are returned to the mother ship only once or twice a day and 100% observation is mandatory.

All other categories are filled in the normal way as described in the section, Method for filling out Set and Catch Forms.

As noted above, one "set" corresponds to one filled set and catch sheet and consists of one round of setting and hauling of the entire fleet of gear used by the mothership regardless of whether or not it used small craft to retrieve and deploy the gear. This procedure normally occurs daily, but with exceptions. For instance, activity at the start of a trip or in a new area may commence late in the day and only setting of the gear is accomplished. Also, bad weather might delay hauling of gear for a day. In these cases, start time, duration and number of nets for the first day gear was in the water would be recorded as 1, 23.9 and 0 respectively. Number of species caught would be recorded as 0 and the catch record would be left blank. This would indicate that the gear was fishing for that day (one day of effort) but no fish were retrieved. On the next day when the gear was hauled, start time and duration would be recorded as above and number of nets would be filled in to reflect amount of gear hauled. The corresponding catch record would then indicate the amount of fish removed from the gear, reflecting the amount caught over the two day period. If the gear is not recovered within two days then no further set sheets should be filled until the day of retrieval. This is done because the gillnet rapidly loses its ability to capture fish after a period of two days due to saturation. However, this situation is rarely encountered, except when weather prevents retrieval of the nets.

Longliners

Fishing by longline, a method commonly used inshore is also used to a limited extent offshore. Countries utilizing this type of gear off Canada's east coast are Japan, Faroe Islands and Norway. The latter two countries use this type of gear to execute cod and turbot fisheries, while Japan and the Faroes use it to capture such large pelagic species as porbeagle, swordfish and tuna.

The gear consists of long nylon lines with baited hooks attached which can be set in the water in various ways depending on the species sought. The lines can be anchored on or near the bottom, a configuration used for cod. For large pelagics the gear is generally set near the surface. The hooks may be attached directly to the main line or to a series of leaders and this also depends on the species sought. See Kristjonsson (1959) and Nedelec (1975) for more detailed descriptions and diagrams of longline gear.

The key item of information in determining effort for longlines is the number of hooks fishing for a particular set. Effort consists of number of hooks hauled in conjunction with the average length of time any one hook is in the water (average duration per hook). As in other fisheries, it is important to match effort with the corresponding catch. Catch for a particular set is the amount taken on all hooks hauled for one longline or set of lines. Consequently, catch per unit effort is defined as an average catch per hook or catch per thousand hooks over a standard time fishing.

Two systems of retrieving and setting longline gear are used and recording of duration for each will vary accordingly. One "set" (the unit of information to be recorded on one set and catch sheet) consists of one round of setting and hauling the complete fleet of lines with which a vessel fishes. The operation is usually accomplished during a single day but may extend into the next. Regardless, set duration is calculated as the average length of time any one hook was in the water. The above holds for both systems of gear useage. The two differ, however, by how long the hooks are held on board between sets. For the first type, all hooks are kept on board until the set is complete and they are then rebaited and set as a unit. For the second type, lines are hauled and set, nonstop. Each hook remains on board only long enough to remove the fish and rebait. Therefore, for this type of operation a particular hook must be identified as the initial hook and tagged. Each time that it appears will signify the start of a new set and the fish landed between appearances of this designated hook are the catch for a single set. Duration is simply the length of time between the first hook set and first hook hauled.

The setting and hauling operation for a single set is continuous, lasting many hours, making direct observation of the whole set virtually impossible. Having up to 30,000 hooks retrieved per set over a period of 15-20 hours is not uncommon, therefore, portions of each set must be observed and the catch figures from the observed portion adjusted to total set length. As with other gear types, converted product weights must also be used as part of the catch estimation procedure. Bycatch and discard estimates can only be derived from observations of the gear as it is brought on board.

Certain categories on the set and catch sheet are completed in a unique manner (refer to Fig. 24). These categories are described as follows:

Codend Mesh Size: Leave this category blank.

Body Mesh Size: Leave this category blank.

Roller Size: Leave this category blank.

Chaffing Gear: Leave this category blank.

No. of Gillnets: Leave this category blank.

No. of Hooks: This category refers to number of hooks hauled for the set. Note that the computer will automatically multiply the number entered by 10. For example, if 30,000 hooks were hauled, the entry in this category would be 3000, not 30,000.

Tow Speed: This category is always recorded as 0.0 because the gear is stationary.

Net Damage: This category will normally be recorded as 1 (no gear damage) because ways in which the gear can be prevented from effectively fishing once in the water are rare.

Set Duration: Completion of set duration will differ depending on the manner in which the gear is set and hauled. As described above, two different methods are used and set duration is calculated differently for each. First, determine which system is being used and then apply one of the following procedures to derive set duration.

Type A - All gear is retrieved and stored on board the vessel between sets, before being set. To derive average time that any single hook was fishing (i.e. set duration) record the following four times in the comments section of the set and catch sheet:

I. Time first hook was set.
II. Time last hook was set.
III. Time first hook was hauled.
IV. Time last hook was hauled.

Using the above information determine the following:

I. Time elapsed between the setting and hauling of the first hook to yield the length of time the first hook fished (convert to hours plus 1/10 hours)

II. Time elapsed between the setting and hauling of the last hook to yield the length of time the last hook fished (convert to hours plus 1/10 hours).

III. The results of I and II represent the maximum and minimum times fished by hooks in that particular set. Next, subtract and average as follows:

Length of time fished by first hook
(result of I) + length of time fished
by last hook (result II) ÷ 2 = average
length of time fished per hook

The resulting value can then be entered on the Set and Catch Sheet under set duration, to the nearest 10th of an hour.

Fishing can extend over more than one twenty-four hour period but the above calculation would still be used. For example, if the first hook was set at 0400 GMT, November 02, and the last hook was set at 0700 GMT, November 02, the first hook was hauled at 1200 GMT, and the last hook was hauled at 0230 GMT, November 03, then:

I. First hook hauled - First hook set
= 1200 - 0400 GMT
= 8.0 hours

II. Last hook hauled - Last hook set + fishing done on November 03
= 2400 GMT, November 02 - 0700 GMT, November 02 + 2.5 hours, November 03
= 17.0 hours + 2.5 hours = 19.5 hours total

Finally, $\frac{8.0 + 19.5}{2}$ = 13.75 hours (the average time per hook). Enter the value 13.8 rounded to one decimal place, in the category set duration.

Type B - In this situation, the gear is hauled and reset on a continuous basis. The gear is not stored on board between sets, rather each hook is baited and set immediately. Under this system, the duration is calculated as the time between appearances of the designated first hook in the complete set. Make sure that it is marked in an appropriate manner for identification. Depending on fishing conditions a set may exceed 24 hours. Actual time that the hooks fished should be recorded for duration.

OTHER ACTIVITIES

The previous sections describe the major types of offshore fisheries, with formats and methods used to capture catch, effort and morphometric information from these fisheries. However, the observer scheme can also yield other information that benefits a wide spectrum of users. Some of these secondary data are tied directly to the commercial fisheries such as production (product to round weight conversion factors are a key example) while others, such as observations of bird and mammal activity, are incidental but no less useful. Most of this type of information was previously not available and hence, is of particular value to a variety of scientific and technical users.

Several data forms have been designed to facilitate collection of these various types of secondary information. Record formats are described in the following sections.

Sampling Report

This noncoded summary is used for bookkeeping purposes by program personnel. Fig. 25 illustrates the format which is designed to summarize the sampling effort on a frequency by frequency basis. Date, vessel name, location, number of lengths measured and number of otoliths taken are recorded and these data are then compiled into a trip summary.

A final amalgamated report is produced from these data. It allows various users to see the sampling levels achieved and the morphometric data available for the various fisheries. The report also provides feedback to program co-ordinators so that sampling levels can be adjusted up or down for specific fisheries depending on requirements and past performance.

Catch/Effort Summary

Figure 26 illustrates the catch/effort work sheet used to record preliminary set by set records of catch and effort. Compilations of these data lists onto catch/effort summary sheets (Fig. 27) provide a timely trip by trip analysis of catch rates that can be used to monitor the fishery. The summary sheets from a trip are amalgamated into the data base immediately upon completion of the deployment. Fisheries information in a variety of forms are then available for all trips returned.

A separate work sheet must be completed for each fishery, that is, separate records kept, by directed species, gear, month and NAFO Division. If, for example, an observed vessel directed for redfish in 3L and 3N in both May and June then four separate sheets would be used, reflecting the changes in area and month. One line of the work sheet would correspond with the data from one set and catch sheet. A line must be completed for each set that occurs during the deployment regardless of whether it was observed or not.

Fill out the catch/effort work sheet by recording on the header in uncoded form, directed species, country, trip, month of fishing, vessel type, NAFO Div., name and year. Next, use the set and catch sheet (Fig. 10a and b) for each corresponding set to extract the appropriate data. In Column 1, record set number. When area or month fished change, carry on with the same set number sequence listed on the set and catch sheets (Fig. 10a), but change to the appropriate work sheet. In the second column, record weight in kg of the directed species. All weights must be recorded in kilograms. This must be done for each of the sets whether observed or from the log. In Column 3, record number of hours fished for that set, to 1 decimal place. In Column 4, record weight of directed catch in kg, for observed sets only. Sets from the log will be left blank. Column 5 is used to record the sequential number of the day fished. For example, the first day fished of the trip would be recorded as 1 and each subsequent day would be numbered sequentially regardless of whether areas or months were changed. In the next column, indicate by a check mark any set that took place outside the 200 mile limit and leave the space blank for sets that occurred inside. In the seventh column, record the weight of the total bycatch (all species) to the nearest kg and then write in the main bycatch species name in the last column. Figure 26 illustrates a specific example.

The appropriate columns of data are then summed at the bottom of the page. If more than one page is required for a particular fishery, then go to a new page with identical header and record number of pages (i.e. 1 of 3, 2 of 3, etc.). Totals for a fishery with multiple pages will appear only on the last page. In the second column, directed catch weight, the total at the bottom includes both observed and log sets. In the next column, hours fished, both observed only totals and observed plus log totals are required (2 spaces are provided). In the next column, observed catch, record total for observed sets total only. Under the day column, record the sequence number for the last day. Finally, sum bycatch weights for both observed only and observed plus log sets in the two spaces provided. All of the above records must be kept up to date during the trip.

At the end of a trip, a work sheet or series of work sheets should be completed for each species/month/area category. These data can then be summarized on the catch/effort trip summary sheet illustrated in Fig. 27. Transferring of summed data from the bottom portions of the work sheets to the summary sheet is described next. Year, page number, name, trip number and country are specified in the header, then fisheries are summarized by directed species, area, month, gear and vessel size in the first five columns. Specifi instructions for completing all of the above categories can be found on the reverse side of the actual catch/effort summary sheet (not illustrated in the manual). In the sixth column of each line, record number of hours of fishing observed, specified to one decimal place (by month and area). This informatio is taken from the category O-TOT, the observed total at the bottom of the work sheet. Directed catch observed, the 7th column on the summary sheet is transposed from the fourth column, O-TOT of the work sheet. This value must b converted to metric tonnes, to one decimal place. Directed catch per hour is calculated by dividing the value in column 7 of the summary sheet, directed catch observed by the hours observed found in column 6. Observed days in column 9 can be transposed from the 5th column on bottom on the work sheet. Directed total catch is then transposed from column 2, A-TOT on the work sheet and it must also be converted to metric tonnes, to one decimal place. Total observed bycatch (column 11) can be transferred from O-TOT, the 7th column of the work sheet and converted to metric tonnes. Percent of observed bycatch is calculated as the total observed bycatch (column 11) plus directed catch observed (column 7) divided into total observed bycatch, and finally multiplie by 100. This percentage is rounded to the nearest whole number. Finally, in columns 14-16 record the number of sets observed, sets from the log, vessel name, the number of length frequency samples done, number of lengths measured, and number of otoliths collected for each category. These data are then available to be placed into a computer file. Various compiled reports are produced to satisfy the needs of a variety of users.

Fishing Pattern Maps

Figure 28 illustrates the form used to record fishing positions. First, in the header record trip number, year, directed species. For each day fishing (one or more sets performed constitutes a day fished) record the position of the set nearest to 1200 GMT as shown in Fig. 28. These daily positions can then be used to plot points on the fishing pattern maps as illustrated in Fig. 29. Each dot represents a noon position for each day fished. Use separate maps when changes occur in the directed species or month.

Conversion Factor Analysis

On commercial offshore trawlers it is not practical to weigh catches of fish in the round form, hence, conversion factors are most useful in deriving whole weight estimates of the catch from the stored products weights or volumes. For example, weight of blocks of various products are converted to round weight by the production foreman on factory trawlers in order to provide estimates of the original catch. Production figures (from volumetric estimates of the stored product) are recorded in a production log which is provided by Canada when the vessel enters the zone. In a similar manner, the observer can make use of this method by applying techniques described in the following sections to arrive at an independent estimate of catch weight from product weight. Applying a valid conversion factor to each stored product type yields an estimate of round weight for each species kept. This is an important step in determining final catch weight estimates for each set (see section on Techniques of Observing Sets).

Prior to 1982, there were no published scientific studies to validate the factors used by a variety of fleets. In 1970, FAO complied a list of currently used whole to product weight factors ("Conversion Factors: North Atlantic Species", Anon, 1970). The most recent update of this list was published in 1980 as "Quantity Conversion Factors: Atlantic Fish Species, Landed or Product Weight to Live Weight" (Anon 1980a). From this, a northwest Atlantic subset was published in Anon. (1980b).

In many cases, conversion factors from this "official" FAO list are used by commercial factory trawlers to derive catch weights. Other unofficial factors distributed by the fishing companies may be used by certain fleets. These factors are of uncertain origin having little or no basis in the scientific literature. Factors used for exactly the same product, species and processing machinery are often different between companies or even vessels of the same fleet, suggesting a problem with these values, hence, the need for an analysis.

Estimating catch weight using production figures is a complicated and variable procedure requiring attention to detail. The following simple example illustrates how product block counts can be used to derive catch. If 1000 blocks of skinless cod fillets weighing an average of 15 kg were produced from a particular set, a conversion factor can then be used to estimate round weight of cod from that set. Using an appropriate conversion factor for that type of product of 3.0 (i.e. 3 tonnes of whole cod yields 1 tonne of fillets) the calculation, 15 kg x 1000 blocks x 3.0, yields an estimate of 45 t of round cod for that set. This basic technique is elaborated in the following sections.

The accuracy of catch figures derived from production weights depends on the precision of the product to whole weight conversion factor used, the accuracy of the average product from block weight and accuracy in counting number of product blocks. Usually, accurate block counts are required by the fishing companies for their own records but when this is not done, volume of the total blocks divided by average volume of an individual block will provide a block count estimate. With this in mind a system of ongoing analyses was designed to examine the first two problems. Experimental procedures have been designed and are carried out by observers using the actual products produced at sea.

There are a number of factors which affect the amount of weight loss during processing, and a combination of these lead to high variability resulting in conversion factors from run to run. Relatively little is known about yield levels attained in production operations at sea but product types and factors affecting processing are given in Kreuzer (1974). Recently, in Kulka (1983a, b and c) some effects on yield were examined and these results are summarized in the following section. Size and condition of fish, size of the catch, specific subprocess methods, differences in individual fish cutters techniques (hand processing) and different machines types are some of the factors that can lead to the observed differences in conversion factors between areas fished, time of year and fleets. The most important of the above mentioned effects are elaborated to provide a background to understand conversion factor experimental strategy.

Production is very complex and often in a single factory several species may each be processed into several types of products. Different machines or subprocesses may be used on a single product category. For example, fillets with skin on or off, trimmed fillets or V-fillets may be produced from the same batch of fish. Each of these subproccesses could have different conversion factors due to differential removal of body parts. Whether a fillet is produced by hand or from a machine (or specific type of machine) can also have an effect. Machines are usually more wasteful and certain models may be more efficient than the others. Size of fish in a particular catch can also have an effect. For example, smaller fish passed through a machine that was designed for larger specimens could cause a reduction in yield. These are only a few examples of how yield can be affected. A summary of experimentally derived factors from 1982 and 1983 (Kulka 1983a and b) is presented in Table III.

The following is a step by step description of methods used to perform a conversion factor experiment under more typically complicated situations. The methods outlined pay particular attention to practical detail and it is this approach which is the key to gathering realistic data from uncontrolled conditions encountered in ships factories. Certain portions of the following description are edited extracts of Kulka (1983c) which should be referred to for a more indepth discussion of experimental technique.

Prior to performing any experiments, it is important to gather relevant data pertaining to the factory operation. Space is available to record these data in the trip report (see Appendix 2). Specifications for machines used and products produced should be noted and recorded. It is particularly important to observe and define the production subprocesses and the extent to which each is used. For example, if 30% of cod are produced as skinless boneless fillet and the rest is skinless product for a particular set, then this 70/30 ratio must be recorded on the set and catch sheet under the last section of the catch record (Fig. 10b). Space is provided for a specific process code (refer to Appendix 3) and a percent of catch. This must be done for each species and each set, regardless of whether it was observed or taken from the log.

By a series of observations throughout the trip, actual machine and factory capacities can be estimated and compared to theoretical capacities recorded in the processing machine manufacturers handbook. Factors that limit maximum turnout should be noted. Included in the written report should be a narrative specifying how production figures, fishing log figures, and reported catches were derived. An accompanying diagram of the factory, showing layout of the various processing machines and a flowchart of processing routes will also aid in the definition of factors that limit turnout, processing efficiency and product yield. Each section of the narrative report illustrated in Appendix 2 provides specific instructions for completion. Refer to these section headers when compiling the production data. This should be done at the start of the trip so that the subsequent conversion experiments can be performed efficiently.

The handling of various species can differ quite significantly between countries, fleets, or even individual vessels. To avoid confusion, each process encountered should be documented in the report and accompanied by diagrams of fish showing such details as cut angles and extent of trimming. Factors that might adversely affect product yield should also be recorded. These may range from quality of fish, biological influences such as gonad size or fish size, to quality and maintenance of equipment (poor quality leading to excessive waste) and the extent of hand trimming performed. Finally, a record must be kept of the conversion factors in current use by the vessel and their origin, where possible. To insure proper experimental procedures and sample selection, much of these data should be compiled during the first few days of the trip. Particular attention must be paid to such practical details as convenient sampling position as well as observation points along the route of production.

Once practical aspects such as sample site selection are worked out, consideration can be given to the actual experimental steps. In performing an experiment, the aim is to extract a normal batch of whole fish from the catch, weigh them, turn them over to the production crew for processing in the normal manner and then reweigh the product. This process must reflect as much as possible the average production sequence. Whole weight of the fish divided by product weight provides the estimate of conversion factor. At the sample selection stage, in order to simulate actual factory conditions, the sample can be selected by factory personnel. In theory, if the aim is to determine an average factor for a vessel, random size samples of a single species should be collected. A processing machine, however, is restricted in the size of fish that it can process. With a sample of all sizes of fish taken from a catch, it is possible the size of some fish may fall outside the processing efficiency limits of the machine. When this occurs, the under or oversized fish will have to be removed, leaving a preselected size range conforming to the machinery. Forcing improperly sized fish through a processor would produce uncharacteristic results. Complete randomness is not preserved by this subsampling method for testing of a particular machine but it does simulate actual conditions. However, the machinery can often accommodate a wide size range and outsizing tends to be a minor problem.

Most vessels carry several types of machines for a single process that together can handle the full size of fish being caught. In order to determine an average conversion factor, regardless of machine or combination of machines used for processing, the randomly selected sample must be partitioned into size strata conforming to the size range capabilities of each of the machines being used. Each component of the original sample can then be put through the appropriate processing machine. For this approach, the experimenter would have to select a sufficiently large sample (about 250 kg) such that there are enough fish in the smallest component. Sending an insufficient number of fish through a machine could produce unreliable results given the considerable variability in the position of flesh cuts and subsequent proportion of parts removed. The sample components, once processed, can be recombined and weighed. This multimachine approach has two drawbacks. First, it does not illustrate differences between machines. Second, two or possibly three machines would have to be monitored simultaneously. Considerable preparation, attention to detail and a team of two would be necessary to perform this type of operation, hence it would be used only in special cases. Alternatively, a series of independent size selected samples conforming to each of the various machine types can be processed individually and then post-weighted according to the actual size distribution in the catch. This is the most logical approach for the singly deployed observer. Both of the above methods will result in an average conversion factor for the size of fish taken the second will yield data differences between machines.

A second and more specialized type of experiment would involve choosing a range of size selected samples in order to test the effect of fish size on magnitude of conversion factor. Each sample would comprise a very narrow range of fish size. Since overall variance is quite high, relatively large numbers of samples are necessary in order to obtain a clear answer with respect to correlation between size of fish and size of conversion factor over the range of a particular machine or over the range of all sizes caught. Hence, only when there are two observers per vessel will this type of experiment be conducted.

Previous work has determined that in most cases 250 kg is a practical upper limit for sample size. On some vessels, the limit may be lower and sample size will have to be adjusted accordingly. Samples larger than 250 kg can, however, cause excessive disruption to the factory operation on some vessels as well as creating too large a workload for the experimenter, thereby reducing monitoring effort. A sample of about 250 kg will delay regular production for only about 20-30 minutes if properly planned.

For the sake of portability, it is necessary to use light, compact scales. "Chatillon" brand spring dial models of 100 kg capacity, similar to those used on research vessels, are adequate. Heavier but still portable triple beam balances (i.e. "Chatillon" model PBB52) may provide superior measures as they are affected less by vertical movement due to sea swell. Some accuracy in sample weights is sacrificed using portable models but practical matters such as sea transfer dictate that they be used. To overcome part of the problem, a second scale might be used to verify the first reading. Ships scales can often be used for this purpose since they are usually quite accurate.

Samples thus obtained (random or size selected and weighing about 250 kg) must be carefully measured and counted. The preliminary length and weight data can then be recorded with modifications on a standard length frequency sheet as illustrated in Fig. 30. When measuring fish for a conversion factor experiment, it is not necessary to remove otoliths or sex the fish but the normal cm grouping should be used. After completing the frequency, calculate mean length of the sample as shown on Fig. 30. This information will later be transferred to the summary sheet.

Once the appropriate morphometric data have been recorded on the length frequency sheet, the production equipment selected for the experiment should be cleared of fish and the sample can then be passed through the machinery. It is important to monitor each stage carefully making sure no fish are added or removed on purpose. Any occurrences leading to abnormal yield should be recorded. Careful monitoring procedures and attention to detail are essential through all stages of the operation.

Since loss of some product units (i.e. fillets) during normal processing is not unusual, it is important to count not only whole fish in the sample prior to processing but also the product units as they emerge from each stage. For example, if 80 fish comprise the sample, the count of fillet product must not exceed 160. Some fillets are often lost during the processing, therefore, number lost should be recorded for each experiment on the comments section of the conversion factor data summary sheet (Fig. 31). This ensures that error will not be introduced into the results due to abnormal product loss or gain. Often, practical problems related to processing by the crew arise and can affect the outcome of the experiments. Any abnormalities in processing procedures should be noted on the data summary comments section (Fig. 31). Insure that no special measures are taken by the crew during the experiment, such as tuning of machinery or more careful trimming procedures. The aim is to obtain an average value reflecting typical product yield rather than a machine optimum factor. If there are intermediate processes such as heading and gutting before filleting, the intermediate product weights should be recorded. A separate experiment is thus created for each product substage. In this way, experimental efficiency can be maximized. The final step is to divide whole weight by product weight for each stage to yield the conversion factor estimate for a particular experiment.

An additional form, the Fillet Production Data Summary Sheet (Fig. 32), must be completed for experiments where fillet is the final product form. Filleting is a complex procedure requiring additional information, hence, this form is designed to capture the subproccessing details. It is not coded and each section must be filled in as specified. Record trip and set number, date, vessel, species processed, average fish length in the sample, the various machines used to derive the final product, area, depth, fish quality, condition (circle one for each category), and specify if trimming was done. This will complete the header. For the section, "Production Stage", determine the appropriate illustrated process that matches the product. Include all stages of the production. Specify for each stage the machine used, weight of the total amount of product produced from that set and specify what percentage of the fish was processed in this manner.

Removal of additional flesh by hand in the post machine treatment can affect the yield significantly. It is, therefore, important to record extent of trimming. Indicate with a yes or no which parts were removed and the % of production for that set for which this was done. All the above information will be used to augment the experimental data obtained.

When the two preliminary data records are complete (Fig. 30), the raw data, sample weight, counts, and mean size of fish (unsexed) can then be summarized onto the Conversion Factor Data Summary Sheet (Fig. 31). Include in the header and main body the following information: vessel name, vessel identifier (side number or CFV), species processed, flag of vessel (country code), sample number (consecutive sequence), set number, date, process method, whole weight of fish (kg), product weight (kg), number of fish in the sample, type of processing machinery, the area fished (NAFO area), and type of sample (i.e. random, size selected). An additional category called "problem type" may be included to identify an experiment which was detrimentally affected.

The following describes step by step how to code each category below the header.

Trip: Fill in assigned trip number.

Side #: Fill in side number of vessel.

Species Code: Code in species using Akenhead and LeGrow (1981).

Country: Code country of vessel with appropriate code from Appendix 3.

Sample No.: Number the experiments consecutively. If an experiment has more than one result (i.e. serial experiments), then each result must have a separate sample number.

Set. No.: Code in actual set number from which the experimental fish were extracted. This information can be obtained from the appropriate set and catch detail sheet.

Date: Code actual year, month and day for the set from which the experimental fish were taken.

Year 1982 = 82

Month Jan. = 1

Feb. = 2
etc.

Day Actual day fished
1-31

Process Method: Refer to Appendix 3, Table 7, for a complete list of processing codes. Detailed process descriptions can be found in Kulka (1983a).

Whole Weight: Write in weight of whole fish used for the experiment, to the nearest kilogram. Be sure to subtract basket weight.

Product Weight: Code in weight of fish product (kg) obtained from original sample of whole fish.

Conversion Factor: This number is obtained by dividing the whole weight of the sample by the resulting product weight.

$$\text{Example: } \frac{\text{Whole weight}}{\text{Product weight}} = \frac{172 \text{ kgs}}{106 \text{ kg}} = 1.62 \text{ (Conversion factor)}$$

Five spaces are allotted for conversion factor. All factors are rounded to the two places. For example, 1.624 is coded as 1.62.

No. of Fish: Record the number of fish used in the experiment. This can be summed from the length frequency.

Mean Length: Determine the average length of all fish in the sample and record to the nearest cm. To determine average length, take the midpoint of the strata or interval and multiply it by the number of fish in that strata. Do this for each strata and add. This will yield total length of all the fish. Divide that total by the number of fish in the sample to yield mean length.

Machine Type: Place the first letter of the brand name of the processing machine and the numeric designation in the space provided. For example, Baader 440 is coded as B440. Hand processing is coded as 1000.

Problem Type: Refer to Appendix 3, Table 6, for a complete list of problem types and codes.

NAFO Division: Code NAFO division where the set occurred, i.e. 2J codes as 2J.

Sample Type: This category refers to the type of sample selected for the experiment and is coded as follows:

1 = Random Sample: Refers to a sample representative of all the fish in the catch of the species being used in the experiment.

2 = Machine Random: Refers to samples of fish selected for a particular machine capable of processing a certain size range of fish. Within the size range of the machine, fish are selected so that they represent an average production run for that machine.

3 = Size Selected: Is a sample of fish with a very narrow size range (usually from 2-4 length strata). This type of sample is obtained to determine the effect of fish size on the conversion factor.

In summary, the following steps briefly summarize experimental procedures which will lead to a completed summary sheet:

1. Analyse the production layout in the factory and decide exactly how to obtain the sample. Note how many products are produced in the factory operation and distribute sampling effort appropriately.

2. Select and weigh a group of fish. Record numbers, lengths and weight of whole fish on the length frequency sheet.

3. Check that the machine used for the experiment is completely clear of fish from the regular production before proceeding with the experiment. Note any lost product and insure that fish not included in the original sample do not become part of the product. The sample should be processed in the normal manner (i.e. with no special care taken or machine adjustments made to artificially improve yield). Distribute experiments over various shifts to allow for variation between factory personnel. The aim of the experiments is not to obtain values of optimum yield but rather an average figure reflecting typical factory conditions.

4. Count and weigh the product from the sample after the fish have passed through the machine. For a serial experiment record weight at each subprocess stage. For fillets, product weight would be recorded after heading, filleting, skinning and trimming. Such serial experiments are useful in determining yield reduction attributable to each subprocessing stage.

5. Record on the Conversion Factor Data Summary (Fig. 31) the relevant data. Signify problem type and provide comments for any unusual occurrences.

By following the above procedure carefully and observing and recording all anomalies, experiments can be run successful. Two per week are usually required.

The other problem in estimating catch from production figures is average product block weight used. If, for instance, the average block weight used to estimate product weight from a block count is in error by 30%, this error level would carry into the catch weight estimate after application of a conversion factor. It is, therefore, important to monitor values used by the various fleets. Each product may be made into a different block size, thus, separate experiments must be carried out for each different product. Fig. 33 illustrates the form used to capture this type of data. It is an uncoded format designed to accept data from one experiment per line. After compiling the header by specifying month, country, vessel and area, record species and product type in the first two columns. Give full details of subprocessing. In the third column, specify experiment number and in the fourth column specify number of product blocks weighed (about 10 blocks per experiment). In the fifth column, specify the total weight of the blocks to the nearest kg and in the sixth column, the average block weight (column five divided by column four). For comparison, the seventh column is used to record the product block weight used by the production foreman for deriving ship's estimate of product weight. Two experiments of this type should be done per week.

Gear Diagrams

Figure 34 and 35 are diagrams of bottom and mid-water trawl. Fill in the blank spaces giving the dimensions of the fishing gear that is used. Explanations of gear structure will be given in the training session. The captain can also be of assistance in compiling gear specifications. Refer to Kristjonsson (1959, 1971), Anon. (1964), Garner (1967, 1978), Nedelec (1975), and Thomson (1978) for comprehensive descriptions of fishing gear and their operation.

Other

Figure 36 illustrates the form used to record data on tagged fish collected. If a fish is obtained with tag intact, freeze, label and bring it back to the lab describing where it came from, the date and other set information if known. Fill out the relevant data on the Tag Information Form.

Figure 37 is to be used to record whale sightings observed during a trip. It should be filled out as in the example, recording time, location, species, number of whales, their heading, weather, sea state, and auxillary observations. Almost all sightings are made during the summer, particularly on the Grand Banks. Refer to Leatherwood et al. (1976) and Hay (1979) for diagrams and descriptions of the whale species in our area.

Figure 38 is used to record the otolith records, including age. This form is filled out in the lab after the trip is completed. Full details for coding this sheet are given in Appendix 3, Table 5.

DEBRIEFING

At the end of deployment, a debriefing is necessary to finalize the accumulated records. These sessions may take up to two days for final upgrading of the forms, including the trip report. This session should take place right after the completion of the trip. Duties included in the debriefing session are: final check of all data sheets, summary of fishing pattern maps, completion of special projects, finalization of the detailed narrative trip report and making a brief verbal presentation. Once everything is complete and has been verified, then the trip is complete. This final stage is critical for upgrading and finalization of the data and must be done immediately following sea duty.

DISCUSSION

THE OBSERVER MANUAL AND ITS USE

While at sea, the observer may encounter unfamiliar situations where the proper steps to be taken are not clear. To determine the correct procedure refer to the appropriate section(s) in this manual. It will serve to answer most questions that arise. For sections most often used, place markers in the pages for quick access. If differences in codes are noted between the text of the Observer Manual and the coding list in Appendix 3, the code list should be regarded as definitive.

DATA UTILIZATION

It is important to understand why the collection of large and complex amounts of fisheries data is a primary function of the Observer Program. The data collected is useful in many ways for managing the fishery and large amounts are necessary because there is a great deal of variability in and between fisheries. Interpretation of data is a highly complex procedure. There are many stocks of fish distributed over a large area and many interactions such as migration and feeding patterns can affect the fishery. This type of complex biological system requires a program involving high coverage levels to obtain a reasonable degree of reliability in the data collected. When dealing with a small portion of the fishery such as a single stock, concentrations of fish within the stock may contain different size ranges of fish with different sex ratios resulting in a complex community structure. It would require extensive coverage to obtain a true picture of the population, particularly that portion removed by the fishery. For this and other reasons, observing and sampling only a small portion of the catches could lead to some incorrect conclusions.

The following are some of the many ways in which the data are used. In determining the weight of each species caught, the fisheries scientist is, in fact, defining the weight of removals of each species from the population. Then, by sampling size and age of the major species, the scientists can determine the numbers of each year class removed and from this can be derived estimates of fishing mortality (F), a key parameter in assessment. A simplified example explains how this is done. If in the second quarter of the year, 100,000 MT of species A was fished from a certain stock, the scientist could combine all length frequencies collected from that stock for that quarter. This would yield a frequency of many thousands of fish that would represent the actual proportion of sizes that were removed from the stock through the fishery in that quarter. Such a frequency might look like Fig. 39. Note that the youngest year classes, in this case one and two year olds, are able to escape the gear.

By calculating the overall average weight of fish in this combined length frequency, the total number of fish caught for the whole fishery can be derived (i.e. Catch weight ÷ Average weight). In our example, if the overall average weight in the quarter is 2.50 kg, then the total number of fish caught is 100,000 MT X 1000 kg/2.50 kg = 40,000,000 fish. The combined length frequency can then be adjusted up proportionally to the total number of fish actually caught to give an estimated length frequency for the entire fishery for that quarter. Estimates of ages of fish at the various length groupings would be determined from otoliths collected when carrying out length sampling. The ageing procedure is similar to ageing a tree from growth rings and is carried out by examining otoliths under a microscope (Fig. 40). What is commonly called an age-length key is then used to arrive at an estimated age composition for the entire fishery. The following example indicates the basic principle behind the use of an age-length key. If a subsample of 35 fish were aged for a particular size grouping in our length frequency, consisting of 5,500,000 fish taken in the fishery and it was found that 25 were five years old and ten were six years of age, then one could extrapolate and say that 25/35 X 5,500,000 = 3,928,000 fish in that size group were of age five, and 1,572,000 were of age six. This procedure could be done for each size group and the number of fish removed in the fishery in each age class could then be determined. If a times series (many years) of numbers of fish removed at each age were available and natural mortality (M) were known, these numbers can then be put through a series of calculations called a cohort analysis to determine fishery mortality and population size of the exploited stock at each age. From this, judgements can be made concerning amounts that can be removed in the following year without damaging (reducing) the stock. This amount is referred to~~as To~~tal Allowable Catch (TAC) and is divided among the various eligible countries as quotas.

The above is a simplified example of fishery management utilizing observer collected data. It illustrates why it is so important that accurate catch estimates be done and representative samples of the catch be taken. If through error the frequencies did not reflect what was caught (for example small fish had been removed before sample selection) then estimates of numbers at age would not be representative of what was actually removed. This could cause error in the analysis and population size could be improperly estimated. A more in-depth discussion of biological and other aspects of fisheries management can be found in Everhart et al. (1975), Gulland (1977), Ricker (1975), and Troadec (1983).

Information on the amount of effort that went into taking the fish is also very useful. If, for example, the catch of cod in 3L was 860 MT over 43 days and 645 hours observed, then catch per unit effort (expressed as catch per day or catch per hour) can be calculated. In this case, the catch per day is 20 t and the catch per hour is 1.33 t. These values can be useful as relative indices of abundance of the population (the higher the value generally the more abundant the fish) within the area sampled. Seasonal fluctuations in abundance can also be defined where the fishery occurs over a period of several months. For example, the 2J+3KL cod fishery experiences very high rates in winter dropping down rapidly in the spring and summer. This pattern confirms the inshore migration away from the offshore breeding grounds that occurs during the period. However, if a downward trend in catch per hour is noticed over many years, this would be a good indication of a decreasing population size.

Foreign countries fishing within the Canadian 200 mile limit are effort regulated (a set number of days for fishing are specified on the license). This provides a degree of control over the fishery, however, to insure compliance the situation must be monitored. The data collected can be used to monitor the catch and effort that the countries report. If large discrepancies occur, the appropriate action can be taken.

During the familiarization course, the observer is introduced to fisheries regulations and given some insight into interpretation of acts, regulations, and policy. In the presence of knowledgeable observers, the vessel captains are less likely to use improper gear, fish in the wrong area, direct for the wrong species or breach the law in any other way. The regulations were set up to protect the fish stocks and to maintain control of the fishery. Observers play a role in watching to see that these regulations are adhered to.

Above are just a few examples of the ways in which the Observer Program benefits fisheries management. The job is a complex and challenging one which must be handled with great care. The observer monitors catches, notes discarding, collects set details, gear and vessel specifications, production and conversion factor figures, helps to define fishing grounds, collects fish lengths and ages by sex, makes whale and bird sightings, carries out fish quality experiments, gathers unusual specimens not otherwise obtaintable, collects tagged fish and invertebrates and at the same time monitors activities of the fleet to insure compliance with regulations.

This training manual is designed to simulate situations in the field to prepare the observer for a variety of duties. It also provides reasons for and explanations of these various duties. Many different situations are covered and it becomes apparent that the observer must be highly adaptable. This manual, coupled with the familiarization course, should prepare the observer for the field work required. The various aspects of the job are summarized on the Observer Program flowchart (Fig. 4), showing the relationships between surveillance duties and biological duties and how these aspects make up a very important part of fisheries management.

REFERENCES

Akenhead, S., and E. LeGrow. 1981. The vertebrates code of the Northwest Atlantic Fisheries Centre. Can. Data Rep. Fish. Aquat. Sci. 309: iv + 58 p.

Amaratunga, T., and R. D. Durward. 1978. Field guide for data collection for the squid, Illex illecebrosus. ICNAF Res. Doc. 78/II/5, 12 p.

Anon. 1964. Modern fishing gear of the world: 2. FAO World Fish. Gear Long. London 1963, 603 p.

Anon. 1970. Conversion factors: North Atlantic species. FAO Bull. Fish. Stats. No. 25, 71 p.

Anon. 1977. FAO Species identification sheets: Fishing area 31: Cephalopods.

Anon. 1980a. Provisional list of conversion factors for selected Northwest Atlantic species. NAFO SCS Doc. 80/VI/6, 26 p.

Anon. 1980b. Quality conversion factors: Atlantic fish species, landed or product weight to live weight. FAO Fish. Circ. No. 725, 217 p.

Babin, A., and B. Wood. 1981. A guide to eastern European fishing vessels frequenting eastern Canadian waters. Observer Rept., DFO, MFD, BIO, 59 p.

Butler, 1980. Shrimps of the Pacific coast of Canada. Bull. Fish. Aquat. Sci. No. 202, 280 p.

Casey, J. G. 1964. Anglers guide to sharks of the northeastern United States, Maine to Chesapeake Bay. Bur. Sport Fish. Wildl. Circ. No. 179. 32 p.

Everhart, W. H., and A. W. Eipper, and W. D. Youngs. 1975. Principles of fishery science. Cornell Univ. Press, Itchica, 288 p.

Garner, J. 1967. Modern deep sea trawling gear. Fishing News (Books) Ltd., London, 62 p.

1978. Pelagic and semi-pelagic trawling gear. Fishing News (Books) Farnham Surrey, 59 p.

Greenway, A. 1981. Comecon merchant ships. K. Mason Publ. Hampshire England, 180 p.

Gulland, J. A. 1966. Manual of sampling and statistical methods for fisheries biology, Part 1, Sampling methods. FAO Publ. Rome, 87 p.

Gulland, J. A. [ed.] 1977. Fish population dynamics. John Wiley and Sons, Toronto, 372 p.

Hay, K. 1979. Guide to identification of whales in Newfoundland-Labrador waters. Research and Resource Services, Department of Fisheries and Oceans, St. John's, Newfoundland, 21 p.

Kreuzer, R. 1974. Fishery products. Fishing News (Books) Ltd., Surrey, 462 p.

Kristjonsson, H. [ed.] 1959. Modern fishing gear of the world. Fishing News (Books) Ltd., London, 607 p.

[ed.] 1971. Modern fishing gear of the world: 3, Fish finding, purse seining, aimed trawling. Fishing News (Books) Ltd., London, 537 p.

Kulka, D. W. 1983a. Methods of determination of fish production conversion factors on commercial factory trawlers. CAFSAC Res. Doc. 83/25, 32 p.

1983b. Analysis of fish production conversion data collected in 1981 from the Northwest Atlantic. CAFSAC Res. Doc. 83/38, 14 p.

1983c. Analysis of cod fillet production conversion factor data from EEC vessels fishing in the Northwest Atlantic, 1982-83. CAFSAC Res. Doc. 83/40, 15 p.

Kulka, D. W., and D. Waldron. 1983. The Atlantic observer programs - A discussion of sampling from commercial catches at sea. In: W. G. Doubleday and D. Rivard [ed.] Sampling commercial catches of marine fish and invertebrates. Can. Spec. Publ. Fish. Aquat. Sci. No. 66: 255-262.

Leatherwood, S., D. K. Caldwell, and H. E. Winn. 1976. Whales, dolphins, and porpoises of the western, north Atlantic: A guide to their identification. NOAA Tech. Rep. NMFS Circ. 396, 176 p.

Leim, A. H., and W. B. Scott. 1966. Fishes of the Atlantic coast of Canada. Fish. Res. Bd. Can. Bull. No. 155, 485 p.

Lilly, G. R. 1982. The marine invertebrate code of the Northwest Atlantic Fisheries Centre. Can. Data Rep. Fish. Aquat. Sci. 365: iv + 44 p.

Nedelec, C. [ed.] 1975. Catalogue of small-scale fishing gear. Fishing News (Books) Ltd., Surrey, 191 p.

Paulsen, M. E. 1956. Length to split (salted) cod to length of round fresh. ICNAF Res. Doc. 12/56, 371 p.

Ricker, W. E. 1975. Computation and interpretation of biological statistics of fish populations. Fish. Res. Bd. Can. Bull. No. 191, 382 p.

Roper, C.F.E., R. E. Young, and G. L. Vass. 1969. An illustrated key to the families of the order Teuthoidea (Cephalopoda). Smithonian Contr. to Zool., No. 13, Smithonian Inst. Press, 32 p.

Smaldon, G. 1979. British coastal shrimps and prawns. Synopses of the British fauna. No. 15, Linnean Soc. London, Acad. Press, London.

Squires, H. J. 1970. Decapod crustaceans of Newfoundland, Labrador and the Canadian eastern Arctic. Fish. Res. Bd. MS Rep. Ser. No. 810, 212 p.

Thompson, D. 1978. Pair trawling and pair seining - The technology of two-boat fishing. Fishing News (Books) Ltd., Surrey, 167 p.

Tibbo, S. N., and W. B. Scott. 1965. Canadian Atlantic sharks. Fish. Res. Bd. Can. Circ. No. 47.

Troadec, J.-P. 1983. Introduction to fisheries management advantages, difficulties and mechanisms. FAO Fish. Tech. Paper No. 224, 53 p.

Table 1. Equipment list - Observer Program.

Items
1. Electrical aids: Calculator
2. Stationary: Stapler and Staples, Ruler, Pens Pencils and Notebook Clipboard and Notepad
3. Biological Sampling Aids: Forceps, Scissors, Scalpel and Blades Knives Stone and Steel Measuring Tape Weight Scales Standard Measuring Board Grenadier Measuring Board Surgical Gloves
4. Reference Material: Leim and Scott Regulation Binder Operation Manual Whale Sighting Report
5. Miscellaneous: Safety, Hard Hat Rubber Gloves Cotton Gloves Briefcases Survival Suits First Aid Kit Apron and Sleeves Plastic Bags and Tags Mesh Measurement Gauge

Table 2. Summary of sampling techniques (Newfoundland Observer Program)

Species	Code	Length meas.	Length group (cm)	Sexed
Cod (*Gadus morhua*)	438	Fork	3	No
Redfish I (*Sebastes mentella*)	794	Fork	1	Yes
Redfish II (*Sebastes marinus*)	793	Fork	1	Yes
Plaice (*Hippoglossoides platessoides*)	889	Total	2	Yes
Yellowtail (*Limanda ferruginea*)	891	Total	2	Yes
Witch (*Glyptocephalus cynoglossus*)	890	Total	2	Yes
Turbot (*Reinhardtius hippoglossoides*)	892	Fork	2	Yes
Halibut (*Hippoglossus hippoglossus*)	893	Fork	2	Yes
Roundnose Grenadier	481	Anal fin	½	Yes
Roughhead Grenadier	474	Anal fin	½	Yes
Blue Hake (*Antimora rostrata*)	432	Total	1	Yes
White Hake (*Urophysis tenuis*)	447	Total	3	No
Capelin (*Mallotus villosus*)	187	Total	1	Yes
Arctic Cod (*Boreogadus saida*)	451	Fork	1	No
Sandlance (*Ammodytes americanus*)	695	Total	1	-
Haddock (*Melanogrammus aeglefinus*)	441	Fork	2	No
Silver Hake (*Merluccius bilinearis*)	449	Fork	1	Yes
Squid (*Illex illecebrosus*)	6011	Mantle	½	Yes
Shrimp (*Pandalus borealis*)	7801	Carapace	1	No

Requirements for the collection of otoliths, frozen samples, and other special requests would be given at the briefing.

Table 3. Selected Experimentally Determined Conversion Factors 1982-83[a].

Species	Product type	Country	Conversion factor	Area
Porbeagle	Gutted, head and tail off	FAROES	1.49	4WX
Cod	Gutted	FRG, UK CAN, PORT	1.22	2H,2J,3K
Cod	Head off straight cut (prefillet)	FRG	1.59	2J
Cod	Gutted head off	JAP	1.71	3L
Cod	Gutted head off straight cut (prefillet)	FRG	1.97	2H,2J
Cod	Split fresh	FAR, FRA PORT, NOR	1.66	2H,2J,3K,3L 3N,3M,4Vn
Cod	Fillet untouched by hand[b]	FRG	3.03	2H
Cod	Fillet skin on, blood spots and fin bits removed	FRA FRG	3.08	2H,4R
Cod	Fillet skinless, blood spots and fin bits removed	FRA FRG	3.20	2H,2J,3L 3Pn, 4Vn
Cod	Fillet skinless periferally trimmed	FRA FRG	3.53	2J,3Pn,4R 4Vn
Cod	Fillet skinless boneless		3.70	
Cod	Fillet skinless boneless periferally trimmed	FRA FRG	4.21	2J,4R,4Vn
Cod	V-fillett skinless		3.70	
RNGREN	Gutted head and tail off	USSR GDR	2.33	2G,2H,2J 3K
Redfish	Gutted	USSR	1.17	3K,30

. . . Cont'd

Table 3. (Cont'd.)

Species	Product type	Country	Conversion factor	Area
Redfish	Head off, straight cut	USSR	1.53	2J,3K,3L
Redfish	Head off diagonal cut	USSR	1.98	3K
Witch	Gutted head off	POL	1.28	2H,3L
Turbot	Gutted head off	USSR POL	1.45	2G,2H,3K
Turbot	Fillet skinless	GDR	2.90	2H
Turbot	Topside fillet	USSR	5.37	0
Squid	Tubed	FRA	2.10	4X
Shrimp	Cooked and peeled	DEN FAR	4.89	0,2H

[a] refer to Kulka 1983a, b and c for an elaboration of how these values were derived and a description of product types.

[b] fillets taken directly from the fillet machine before further processing.

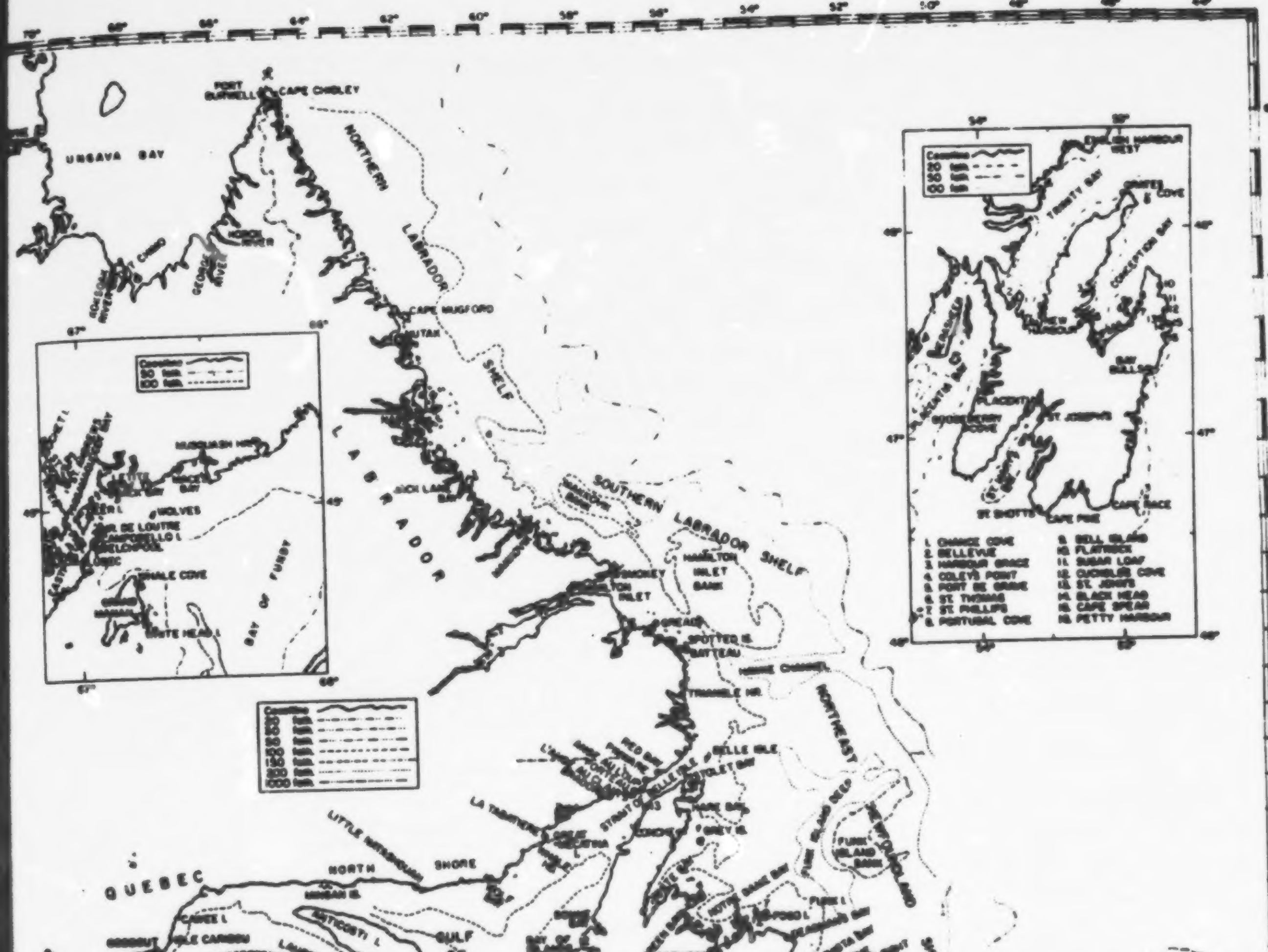


Fig. 1. Chart of the Canadian Atlantic Region showing major fishing banks.

NEWFOUNDLAND OBSERVER PROGRAM
BRIEFING INSTRUCTIONS

Trip #:_____ Name: ______________________________ Date: ______________

Fishery: ____
Country, Vessel, Area, Species-Specify Charter, Research, etc.

Special Instructions: ____

Sampling Instructions:

1. ____________ Catch: ___ Landing: ___ Discard: _____
____________ Sample(s) per day
Sexed: Yes:__ No: ___, ______cm grouping
____________ Otoliths per strata, per trip (per sex). When these requirements are met or should envelopes run out, continue to collect length measurements.

____________ Catch: ___ Landing: ___ Discard: _____
____________ Sample(s) per day
Sexed: Yes:__ No: ___, ______cm grouping
____________ Otoliths per strata, per trip (per sex). When these requirements are met or should envelopes run out, continue to collect length measurements.

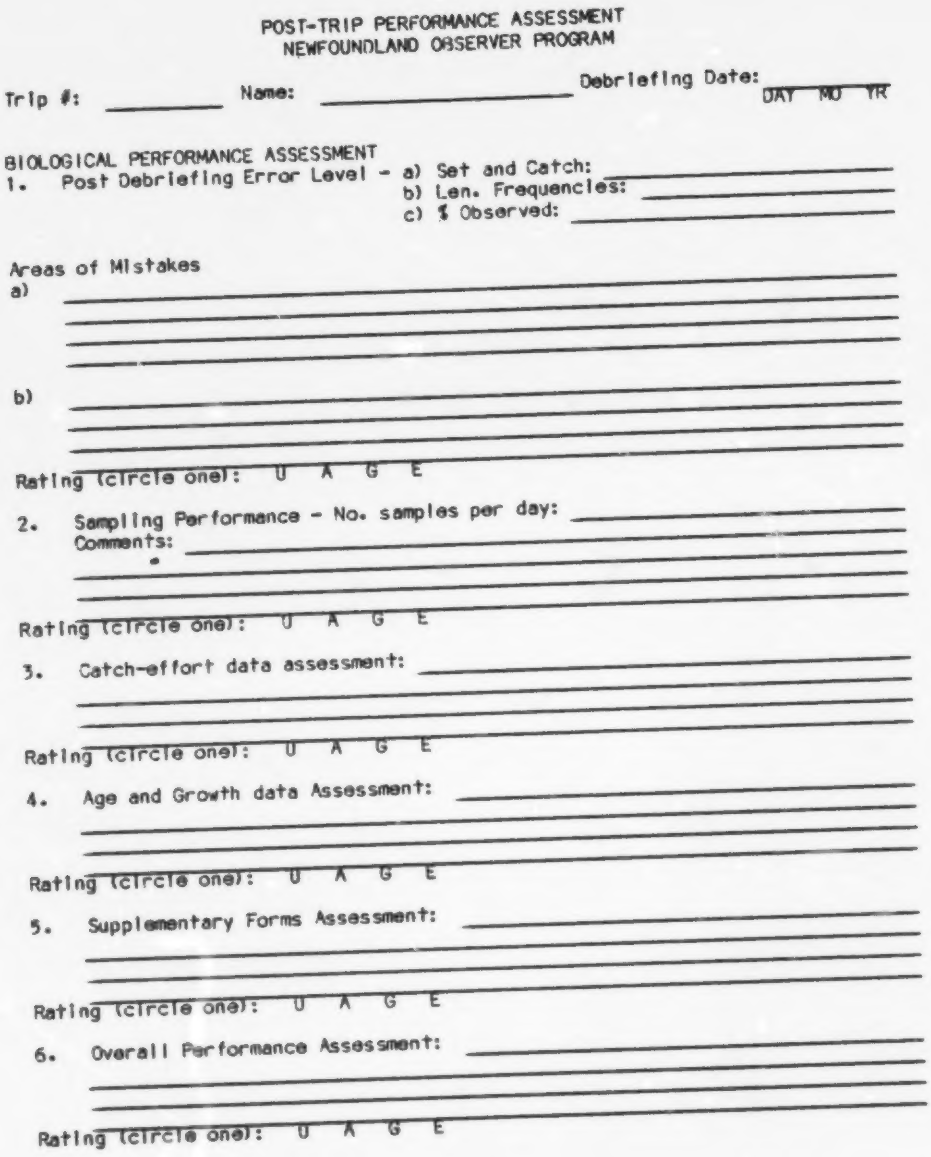
PREVIOUS DEPLOYMENT RECORD

PROBLEM AREAS: ____

Last Assessment: ______________________________

OBSERVER:______________________________ Instructor: ______________

Fig. 2. Observer Program Briefing Instructions.



POST-TRIP PERFORMANCE ASSESSMENT
NEWFOUNDLAND OBSERVER PROGRAM

Trip #: ________ Name: ____________________ Debriefing Date: ________ DAY MO YR

BIOLOGICAL PERFORMANCE ASSESSMENT

1. Post Debriefing Error Level - a) Set and Catch: ____________
b) Len. Frequencies: ____________
c) % Observed: ____________

Areas of Mistakes
a) ____________
b) ____________

Rating (circle one): U A G E

2. Sampling Performance - No. samples per day: ____________
Comments: ____________

Rating (circle one): U A G E

3. Catch-effort data assessment: ____________

Rating (circle one): U A G E

4. Age and Growth data Assessment: ____________

Rating (circle one): U A G E

5. Supplementary Forms Assessment: ____________

Rating (circle one): U A G E

6. Overall Performance Assessment: ____________

Rating (circle one): U A G E

Fig. 3. Post-trip performance assessment-Newfoundland Observer Program.

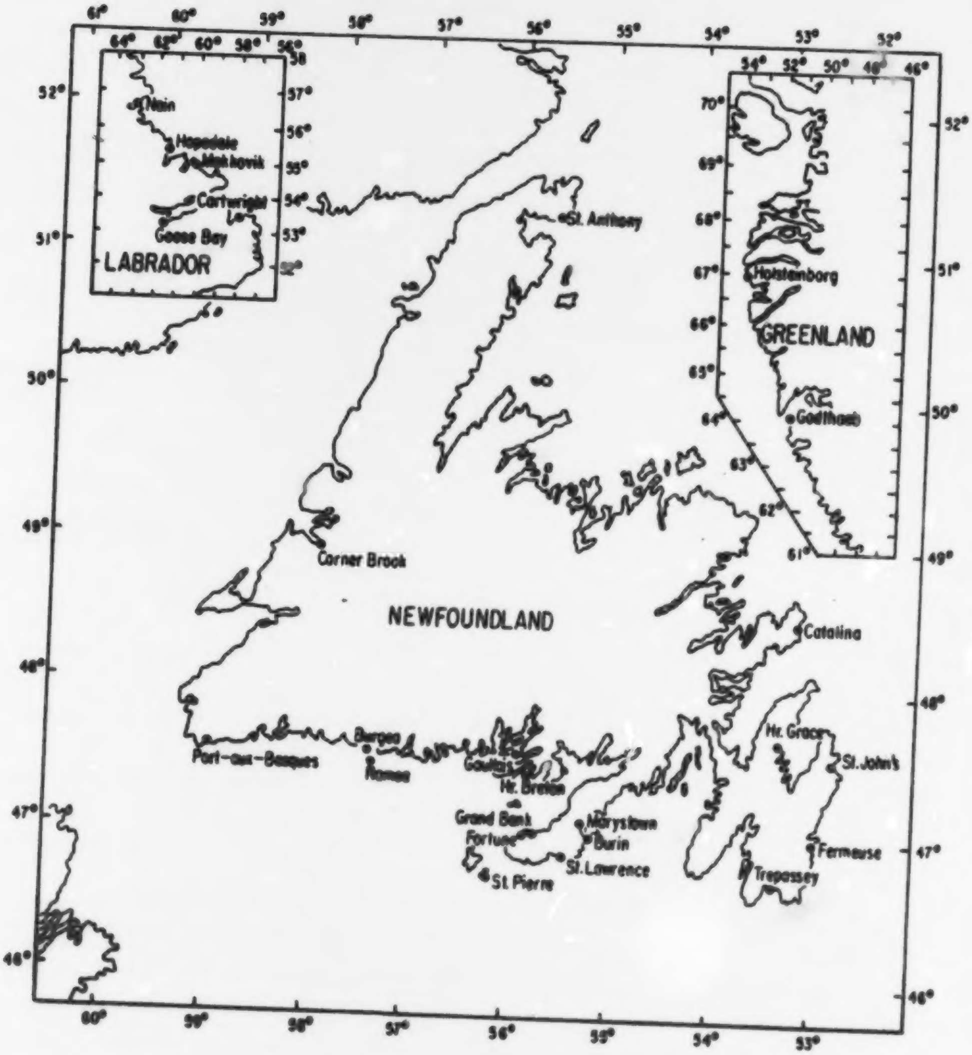


Fig. 4. Ports of embarkation and disembarkation of foreign and Canadian fishing vessels in the Newfoundland Region.

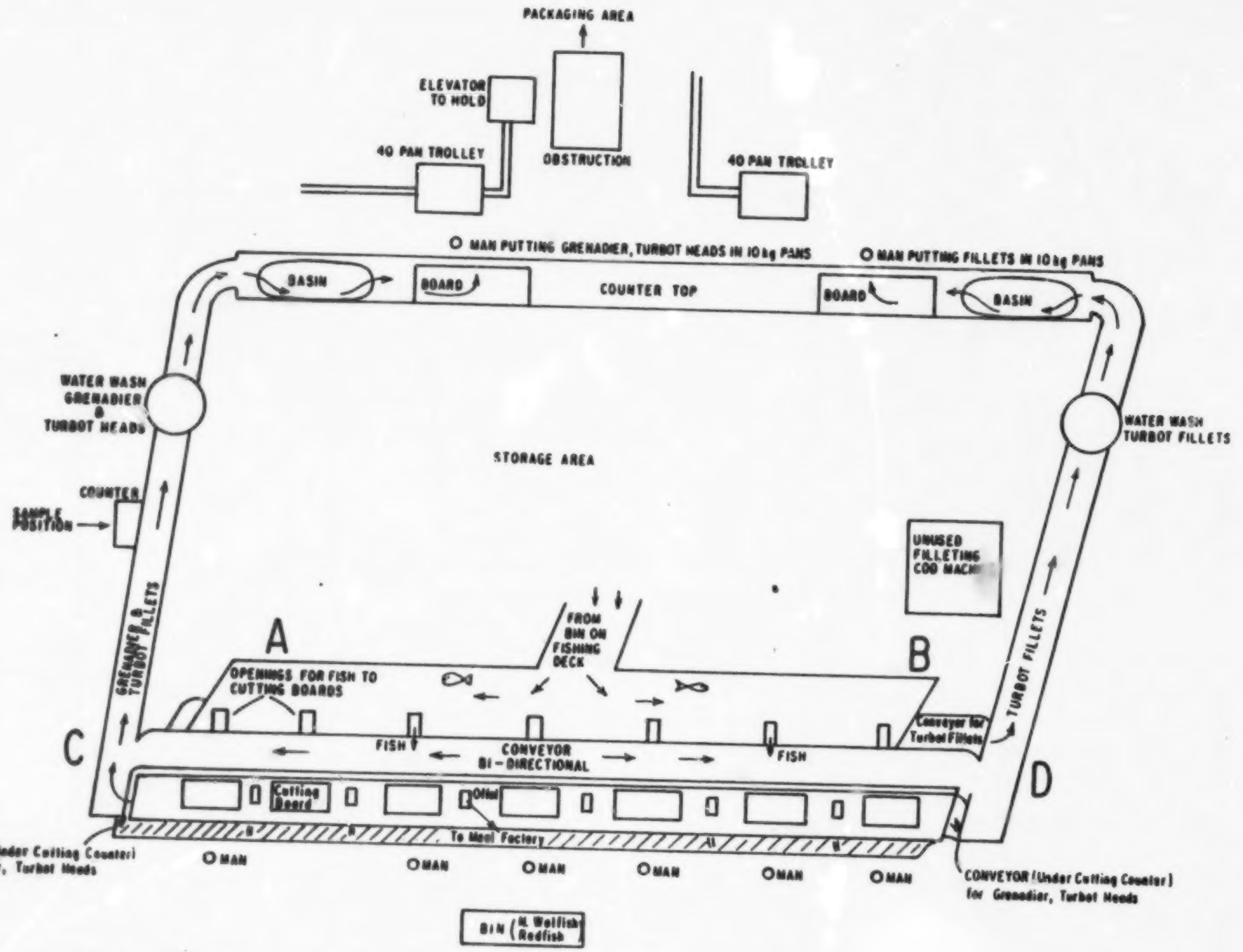

PACKAGING AREA
ELEVATOR TO HOLD
OBSTRUCTION
40 PAN TROLLEY
40 PAN TROLLEY
MAN PUTTING GRENADIER, TURBOT HEADS IN 10 kg PANS
MAN PUTTING FILLETS IN 10 kg PANS
BASIN
BOARD
COUNTER TOP
BOARD
BASIN
WATER WASH GRENADIER & TURBOT HEADS
STORAGE AREA
WATER WASH TURBOT FILLETS
COUNTER
SAMPLE POSITION
UNUSED FILLETING COD MACH
FROM BIN ON FISHING DECK
A
B
OPENINGS FOR FISH TO CUTTING BOARDS
GRENADIER & TURBOT FILLETS
TURBOT FILLETS
C
FISH
CONVEYOR BI-DIRECTIONAL
FISH
Conveyor for Turbot Fillets
D
Cutting Board
Offal
To Meal Factory
CONVEYOR (Under Cutting Counter) for Grenadier, Turbot Heads
MAN
MAN
MAN
MAN
MAN
MAN
CONVEYOR (Under Cutting Counter) for Grenadier, Turbot Heads
BIN (H. Wolfish / Redfish)

Fig. 5. Layout of the factory area for the Kuprin, a large Russian factory ship.

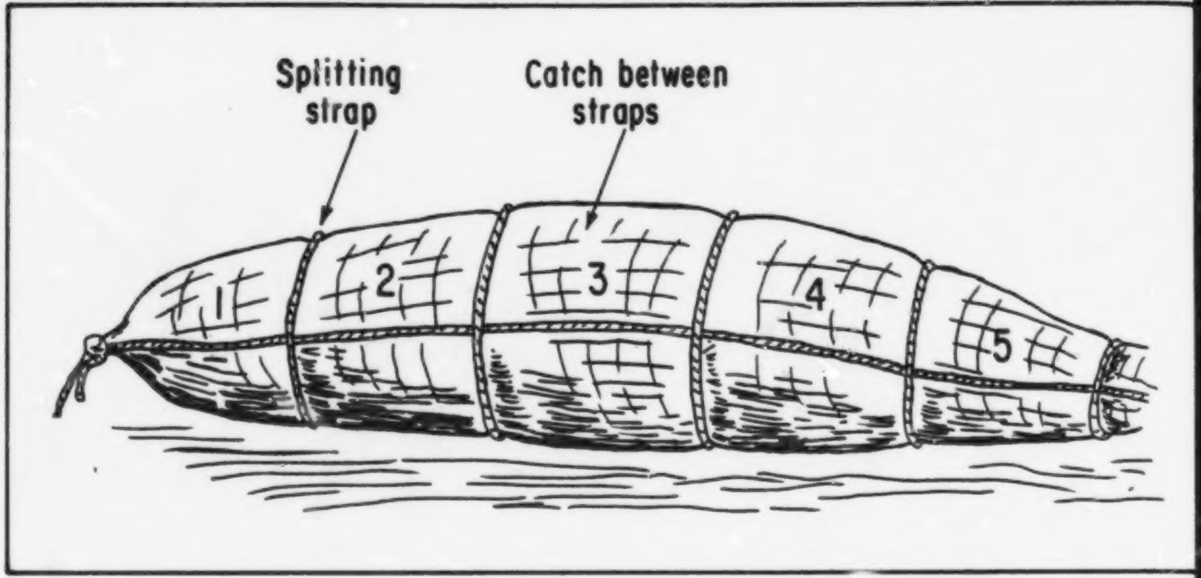


Fig. 6. Estimating total weight of the catch while still in the net using the splitting strap method.

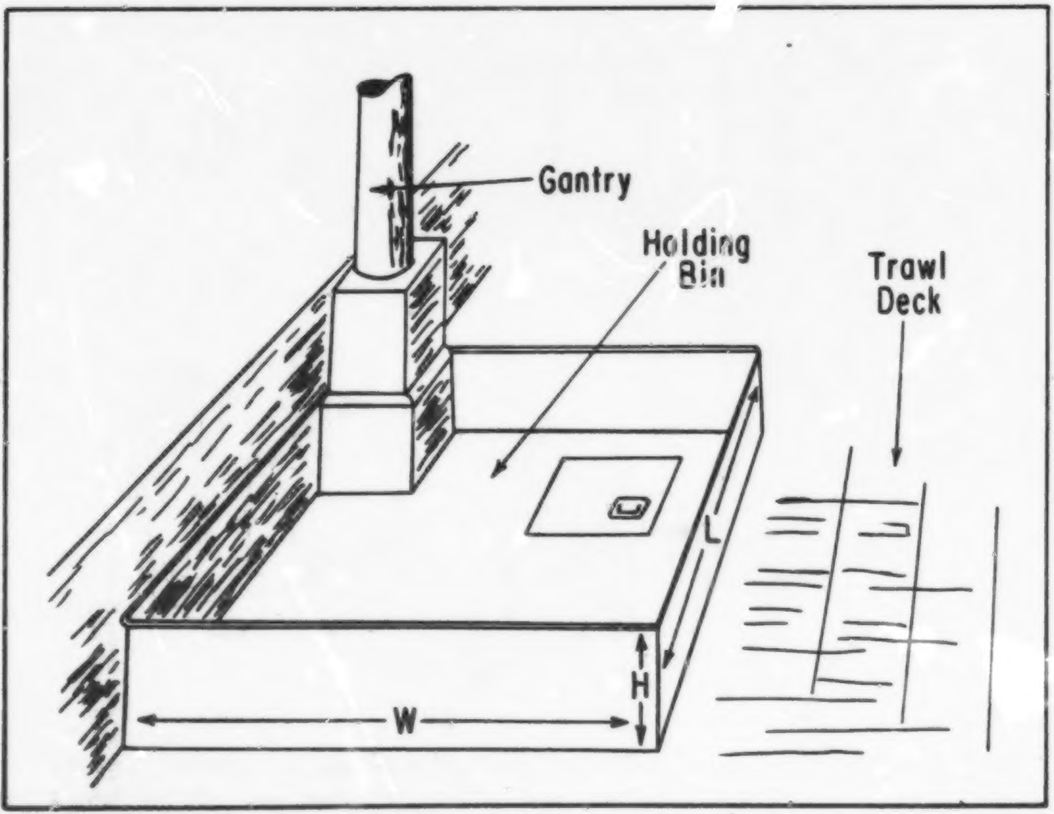
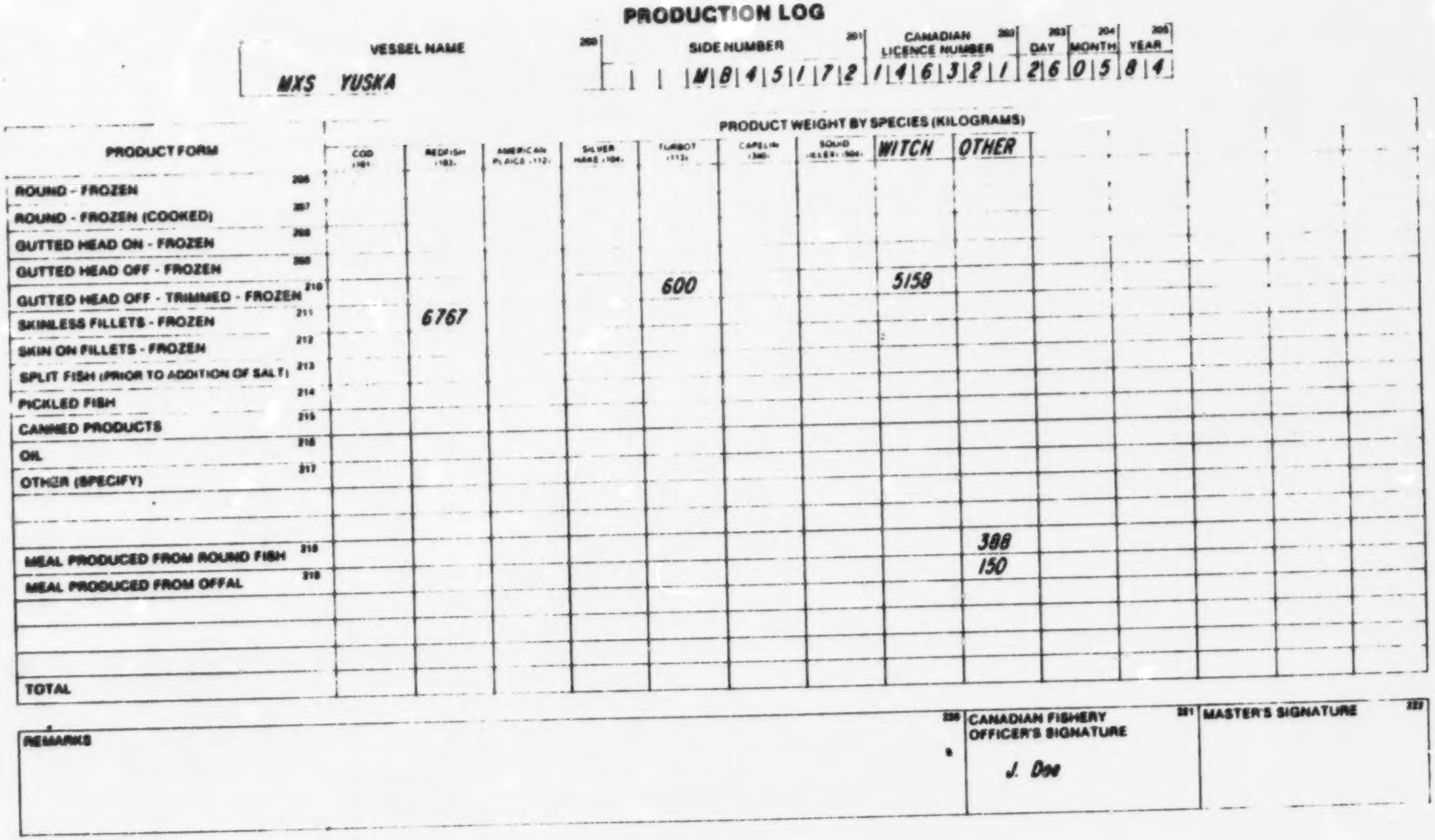


Fig. 7. Diagram of deck holding bin and measurements required for volumetric calculation (L length, W width, and H height of holding area).



PRODUCTION LOG

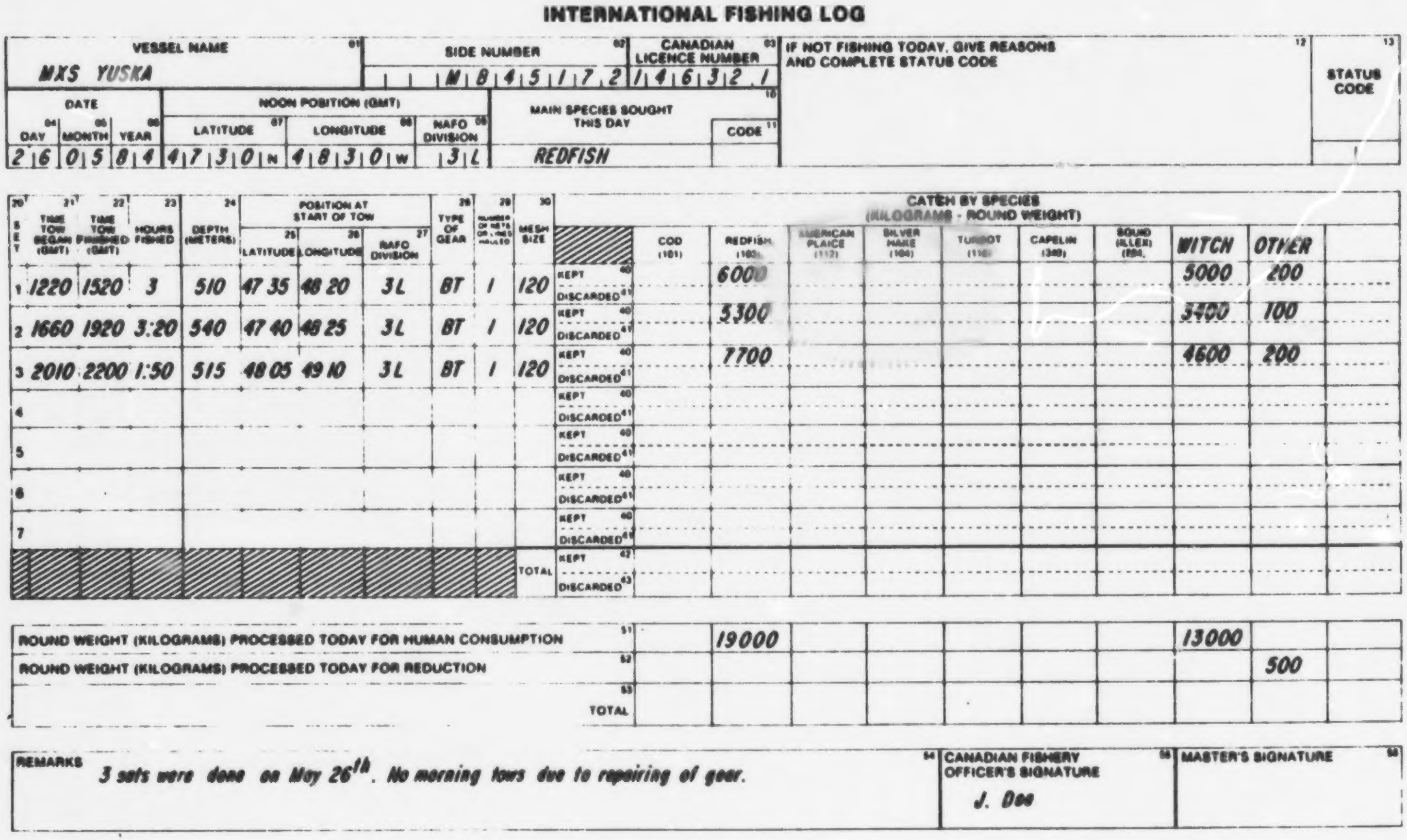
200 VESSEL NAME	201 SIDE NUMBER	202 CANADIAN LICENCE NUMBER	203 DAY	204 MONTH	205 YEAR
MXS YUSKA	MB451172	146321	26	05	84

PRODUCT WEIGHT BY SPECIES (KILOGRAMS)

PRODUCT FORM		COD (101)	REDFISH (103)	AMERICAN PLAICE (112)	SILVER HAKE (104)	TURBOT (113)	CAPELIN (340)	SQUID (ILLEX) (504)	WITCH	OTHER					
ROUND - FROZEN	206														
ROUND - FROZEN (COOKED)	207														
GUTTED HEAD ON - FROZEN	208														
GUTTED HEAD OFF - FROZEN	209														
GUTTED HEAD OFF - TRIMMED - FROZEN	210					600			5158						
SKINLESS FILLETS - FROZEN	211		6767												
SKIN ON FILLETS - FROZEN	212														
SPLIT FISH (PRIOR TO ADDITION OF SALT)	213														
PICKLED FISH	214														
CANNED PRODUCTS	215														
OIL	216														
OTHER (SPECIFY)	217														
MEAL PRODUCED FROM ROUND FISH	218									388					
MEAL PRODUCED FROM OFFAL	219									150					
TOTAL															

220 REMARKS	221 CANADIAN FISHERY OFFICER'S SIGNATURE	222 MASTER'S SIGNATURE
	J. Doe	

Fig. 8. International production log.



INTERNATIONAL FISHING LOG

VESSEL NAME 01 MXS YUSKA	SIDE NUMBER 02 M B 4 5 1 7 2	CANADIAN LICENCE NUMBER 03 1 4 6 3 2 1	IF NOT FISHING TODAY, GIVE REASONS AND COMPLETE STATUS CODE 12
			STATUS CODE 13 1

DATE			NOON POSITION (GMT)			MAIN SPECIES SOUGHT THIS DAY 10	
DAY 04	MONTH 05	YEAR 06	LATITUDE 07	LONGITUDE 08	NAFO DIVISION 09		CODE 11
2 6	0 5	8 4	4 7 3 0 N	4 8 3 0 W	3 L	REDFISH	

20 SET	21 TIME TOW BEGAN (GMT)	22 TIME TOW FINISHED (GMT)	23 HOURS FISHED	24 DEPTH (METERS)	POSITION AT START OF TOW			26 TYPE OF GEAR	29 NUMBER OF NETS OR LINES HAULED	30 MESH SIZE		CATCH BY SPECIES (KILOGRAMS - ROUND WEIGHT)									
					25 LATITUDE	26 LONGITUDE	27 NAFO DIVISION				▨	COD (101)	REDFISH (103)	AMERICAN PLAICE (112)	SILVER HAKE (106)	TURBOT (118)	CAPELIN (340)	SQUID (ILLEX) (194)	WITCH	OTHER	
1	1220	1520	3	510	47 35	48 20	3L	BT	1	120	KEPT 40		6000						5000	200	
											DISCARDED 41										
2	1660	1920	3:20	540	47 40	48 25	3L	BT	1	120	KEPT 40		5300						5400	100	
											DISCARDED 41										
3	2010	2200	1:50	515	48 05	49 10	3L	BT	1	120	KEPT 40		7700						4600	200	
											DISCARDED 41										
4											KEPT 40										
											DISCARDED 41										
5											KEPT 40										
											DISCARDED 41										
6											KEPT 40										
											DISCARDED 41										
7											KEPT 40										
											DISCARDED 41										
▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	TOTAL	KEPT 42										
											DISCARDED 43										

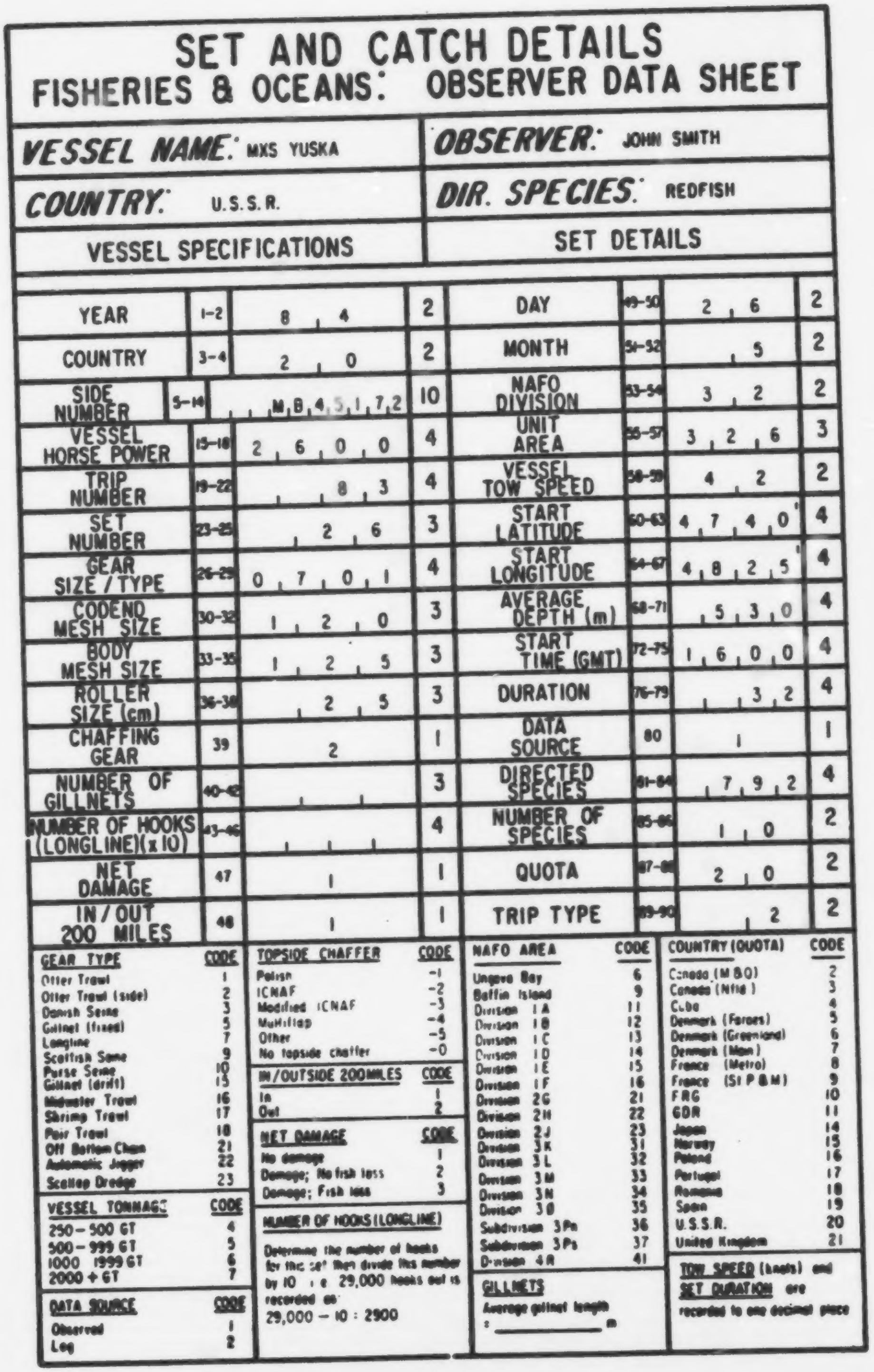
	COD	REDFISH	AMERICAN PLAICE	SILVER HAKE	TURBOT	CAPELIN	SQUID (ILLEX)	WITCH	OTHER	
ROUND WEIGHT (KILOGRAMS) PROCESSED TODAY FOR HUMAN CONSUMPTION 51		19000						13000		
ROUND WEIGHT (KILOGRAMS) PROCESSED TODAY FOR REDUCTION 52									500	
TOTAL 53										

REMARKS 54 3 sets were done on May 26th. No morning tows due to repairing of gear.

CANADIAN FISHERY OFFICER'S SIGNATURE 55 J. Doe

MASTER'S SIGNATURE 56

Fig. 9. International fishing log.



SET AND CATCH DETAILS
FISHERIES & OCEANS: OBSERVER DATA SHEET

VESSEL NAME: MXS YUSKA

OBSERVER: JOHN SMITH

COUNTRY: U.S.S.R.

DIR. SPECIES: REDFISH

VESSEL SPECIFICATIONS				SET DETAILS			
YEAR	1-2	8 4	2	DAY	49-50	2 6	2
COUNTRY	3-4	2 0	2	MONTH	51-52	5	2
SIDE NUMBER	5-14	M B 4 5 1 7 2	10	NAFO DIVISION	53-54	3 2	2
VESSEL HORSE POWER	15-18	2 6 0 0	4	UNIT AREA	55-57	3 2 6	3
TRIP NUMBER	19-22	8 3	4	VESSEL TOW SPEED	58-59	4 2	2
SET NUMBER	23-25	2 6	3	START LATITUDE	60-63	4 7 4 0'	4
GEAR SIZE / TYPE	26-29	0 7 0 1	4	START LONGITUDE	64-67	4 8 2 5'	4
CODEND MESH SIZE	30-32	1 2 0	3	AVERAGE DEPTH (m)	68-71	5 3 0	4
BODY MESH SIZE	33-35	1 2 5	3	START TIME (GMT)	72-75	1 6 0 0	4
ROLLER SIZE (cm)	36-38	2 5	3	DURATION	76-79	3 2	4
CHAFFING GEAR	39	2	1	DATA SOURCE	80	1	1
NUMBER OF GILLNETS	40-42		3	DIRECTED SPECIES	81-84	7 9 2	4
NUMBER OF HOOKS (LONGLINE)(x10)	43-46		4	NUMBER OF SPECIES	85-86	1 0	2
NET DAMAGE	47	1	1	QUOTA	87-88	2 0	2
IN / OUT 200 MILES	48	1	1	TRIP TYPE	89-90	2	2

GEAR TYPE	CODE
Otter Trawl	1
Otter Trawl (side)	2
Danish Seine	3
Gillnet (fixed)	5
Longline	7
Scottish Seine	9
Purse Seine	10
Gillnet (drift)	15
Midwater Trawl	16
Shrimp Trawl	17
Pair Trawl	18
Off Bottom Chain	21
Automatic Jigger	22
Scallop Dredge	23

VESSEL TONNAGE	CODE
250 – 500 GT	4
500 – 999 GT	5
1000 1999 GT	6
2000 + GT	7

DATA SOURCE	CODE
Observed	1
Log	2

TOPSIDE CHAFFER	CODE
Polish	-1
ICNAF	-2
Modified ICNAF	-3
Multiflap	-4
Other	-5
No topside chaffer	-0

IN/OUTSIDE 200MILES	CODE
In	1
Out	2

NET DAMAGE	CODE
No damage	1
Damage; No fish loss	2
Damage; Fish loss	3

NUMBER OF HOOKS (LONGLINE)

Determine the number of hooks for the set then divide this number by 10 i.e. 29,000 hooks set is recorded as:
29,000 – 10 : 2900

NAFO AREA	CODE
Ungava Bay	6
Baffin Island	9
Division 1A	11
Division 1B	12
Division 1C	13
Division 1D	14
Division 1E	15
Division 1F	16
Division 2G	21
Division 2H	22
Division 2J	23
Division 3K	31
Division 3L	32
Division 3M	33
Division 3N	34
Division 3O	35
Subdivision 3Pn	36
Subdivision 3Ps	37
Division 4R	41

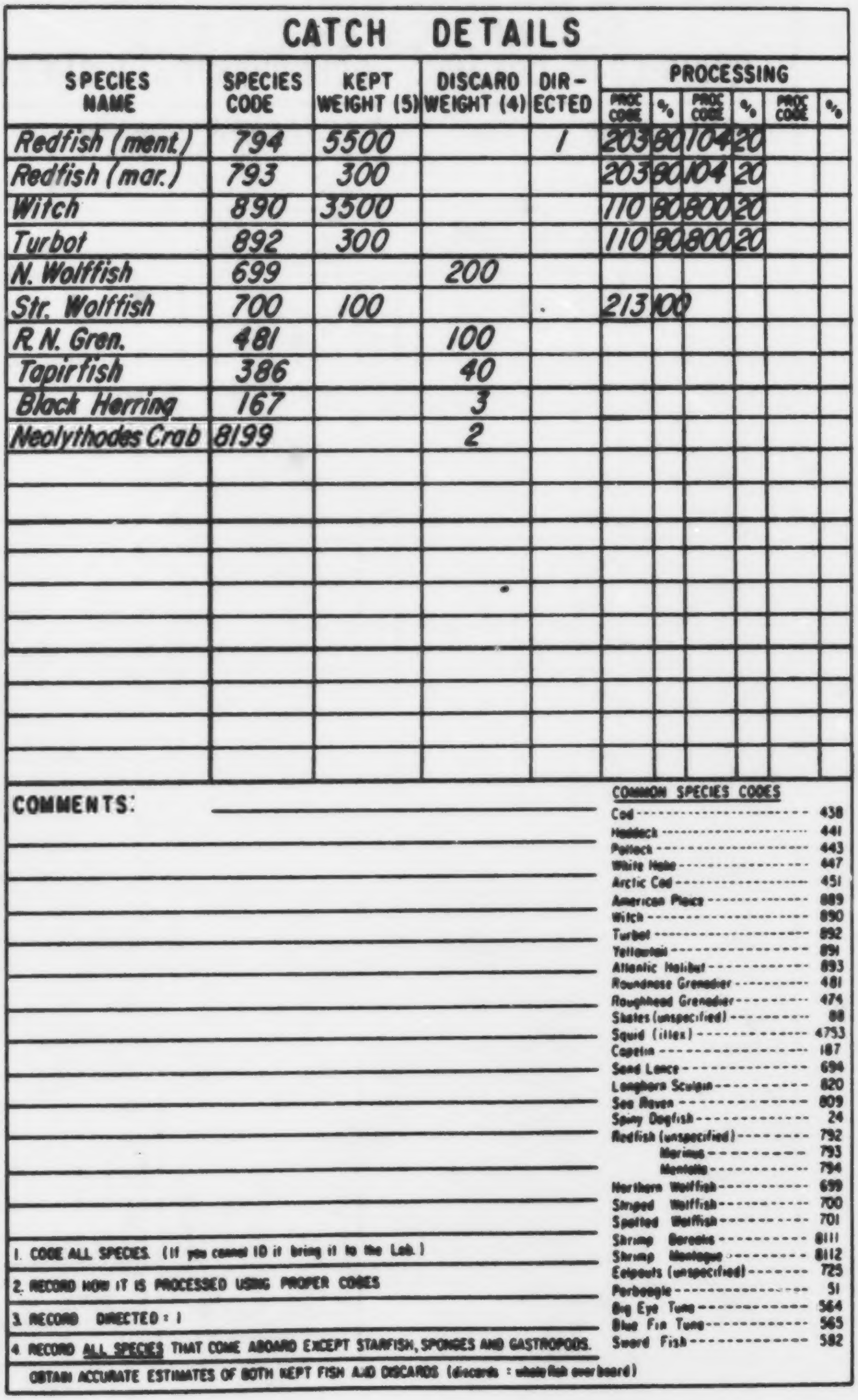
GILLNETS

Average gillnet length
= ____________ m

COUNTRY (QUOTA)	CODE
Canada (M&Q)	2
Canada (Nfld)	3
Cuba	4
Denmark (Faroes)	5
Denmark (Greenland)	6
Denmark (Main)	7
France (Metro)	8
France (St P & M)	9
FRG	10
GDR	11
Japan	14
Norway	15
Poland	16
Portugal	17
Romania	18
Spain	19
U.S.S.R.	20
United Kingdom	21

TOW SPEED (knots) and SET DURATION are recorded to one decimal place

Fig. 10a. Observer Program set detail sheet.



CATCH DETAILS

SPECIES NAME	SPECIES CODE	KEPT WEIGHT (5)	DISCARD WEIGHT (4)	DIR- ECTED	PROCESSING					
					PROC CODE	%	PROC CODE	%	PROC CODE	%
Redfish (ment.)	794	5500		1	203	80	104	20		
Redfish (mar.)	793	300			203	80	104	20		
Witch	890	3500			110	80	800	20		
Turbot	892	300			110	80	800	20		
N. Wolffish	699		200							
Str. Wolffish	700	100			213	100				
R.N. Gren.	481		100							
Tapirfish	386		40							
Black Herring	167		3							
Neolythodes Crab	8199		2							

COMMENTS:

1. CODE ALL SPECIES. (If you cannot ID it bring it to the Lab.)
2. RECORD HOW IT IS PROCESSED USING PROPER CODES
3. RECORD DIRECTED = 1
4. RECORD ALL SPECIES THAT COME ABOARD EXCEPT STARFISH, SPONGES AND GASTROPODS.

OBTAIN ACCURATE ESTIMATES OF BOTH KEPT FISH AND DISCARDS (discards = whole fish overboard)

COMMON SPECIES CODES

Cod	438
Haddock	441
Pollock	443
White Hake	447
Arctic Cod	451
American Plaice	889
Witch	890
Turbot	892
Yellowtail	891
Atlantic Halibut	893
Roundnose Grenadier	481
Roughhead Grenadier	474
Skates (unspecified)	88
Squid (illex)	4753
Capelin	187
Sand Lance	694
Longhorn Sculpin	820
Sea Raven	809
Spiny Dogfish	24
Redfish (unspecified)	792
Marinus	793
Mentella	794
Northern Wolffish	699
Striped Wolffish	700
Spotted Wolffish	701
Shrimp Borealis	8111
Shrimp Montagui	8112
Eelpouts (unspecified)	725
Porbeagle	51
Big Eye Tuna	564
Blue Fin Tuna	565
Sword Fish	582

Fig. 10b. Observer Program catch detail sheet.

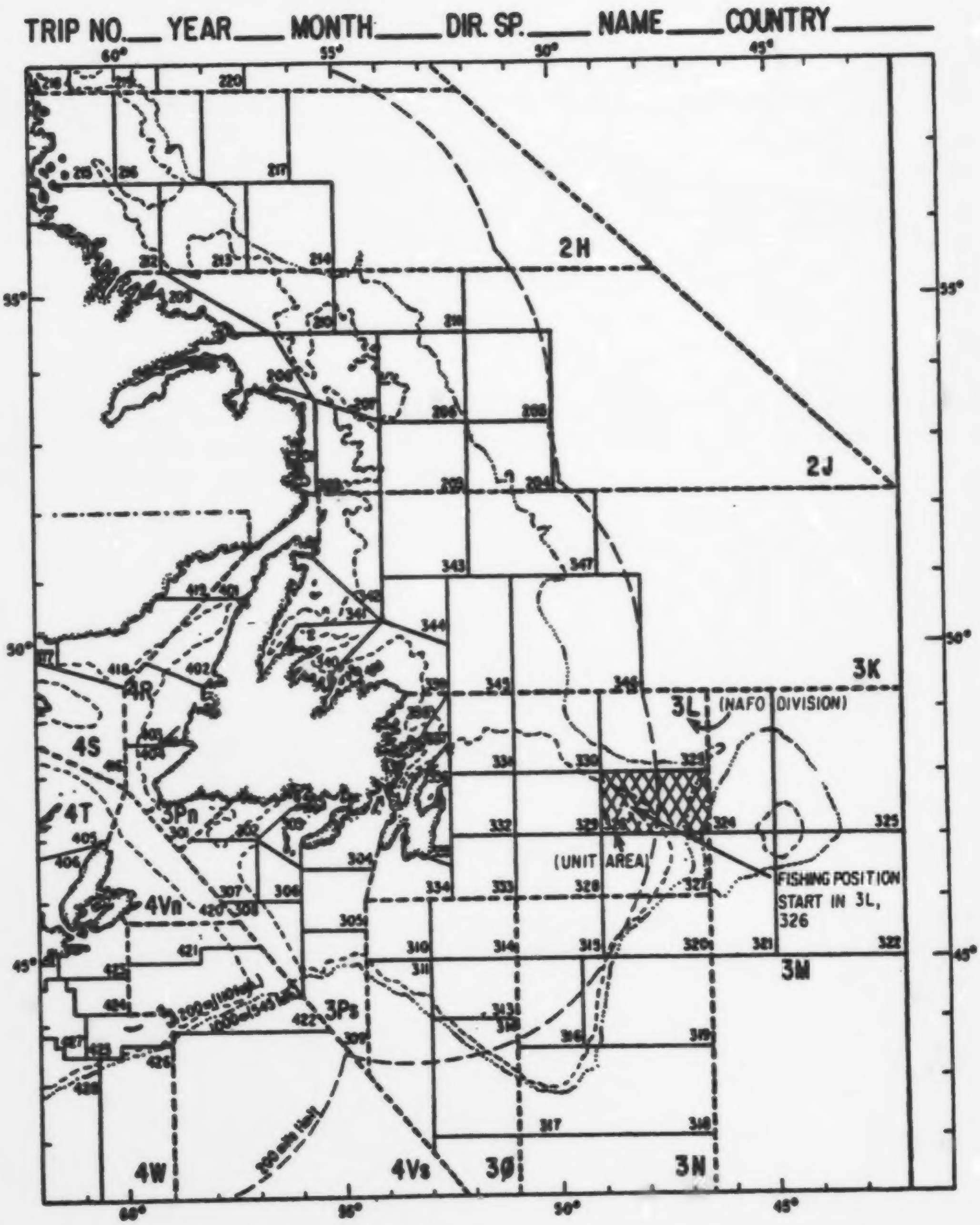


Fig. 11. Map illustrating fishing position with respect to NAFO areas.

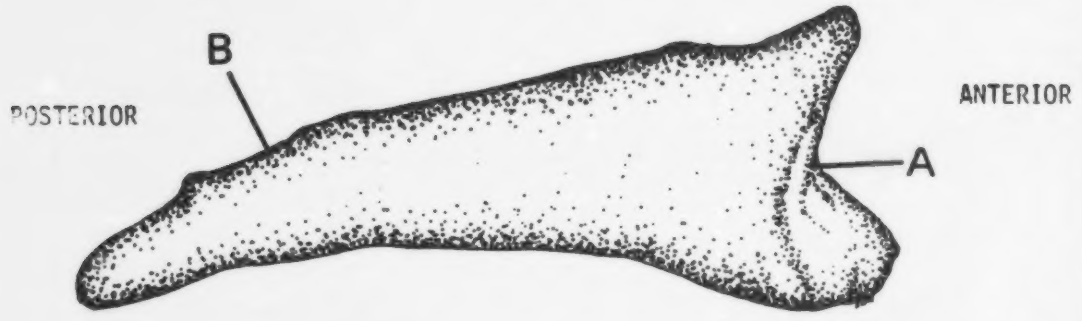


Fig. 12A. Maturing female plaice gonad that has been dissected away from the body. Note the rounded anterior end (A) and the elongated posterior portion (B).

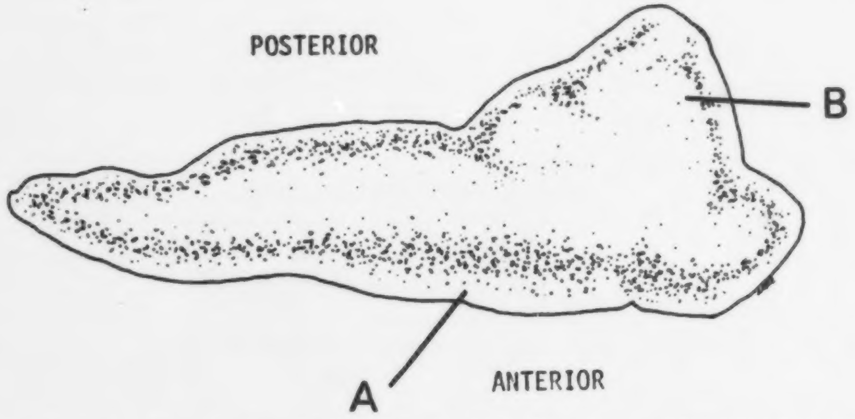


Fig. 12B. Maturing male plaice gonad that has been dissected away from the body. Note the sharp anterior edge (A); the short posterior end (B), and the solid liver-like appearance.

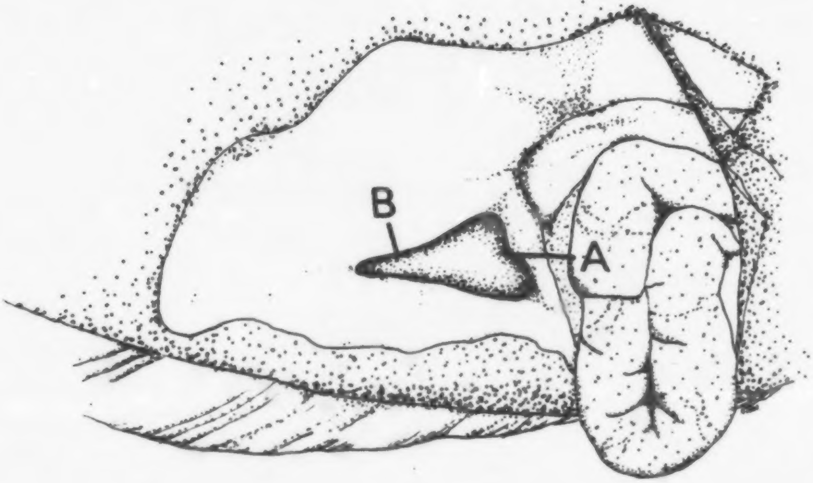


Fig. 12C. Immature female plaice gonad in situ showing its position relative to the visceral cavity. The rounded anterior edge (A) and elongated posterior end (B) distinguish the female gonad.

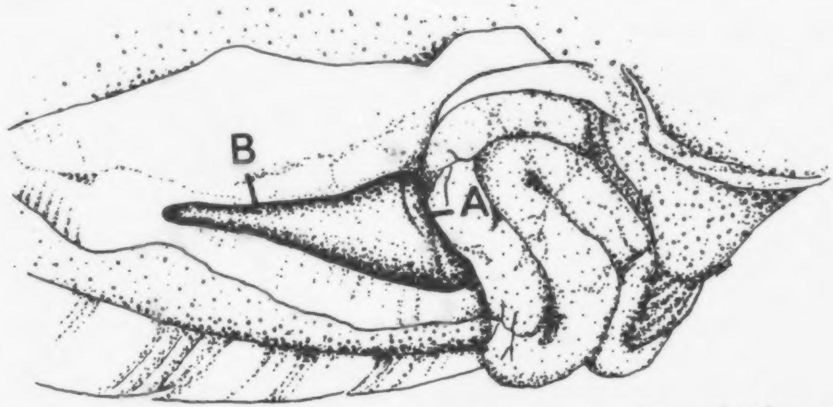


Fig. 12D. Maturing female plaice gonad in situ showing its relative position. The rounded anterior edge (A) and elongated posterior end (B) are distinguishing features.

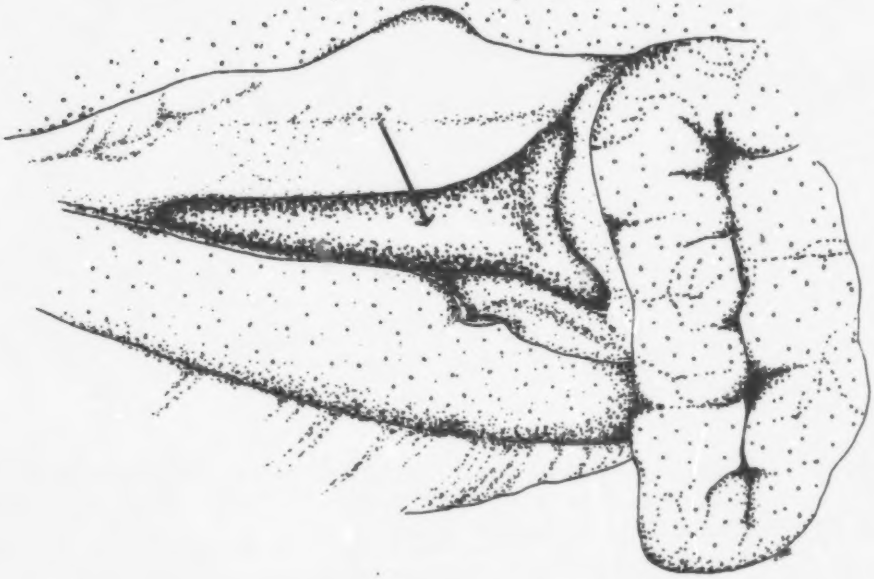


Fig. 12E. Maturing female plaice gonad.

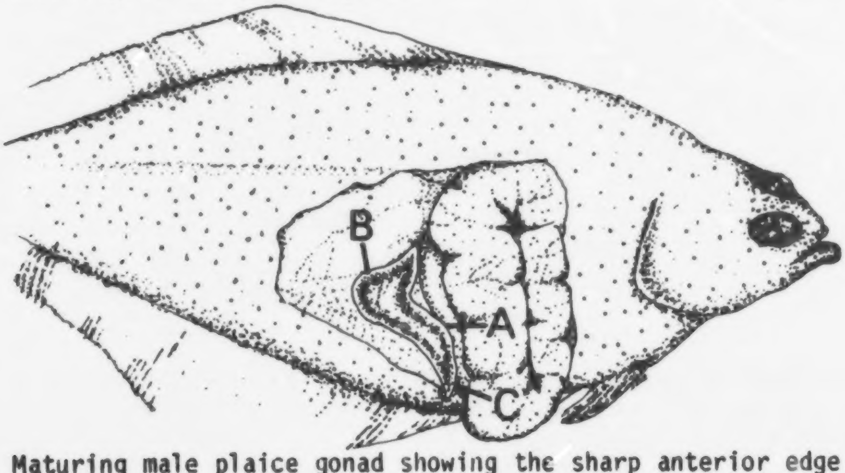


Fig. 12F. Maturing male plaice gonad showing the sharp anterior edge (A) the unproduced posterior end (B), and the elongated anterior portion (C). Note the firm livery texture.

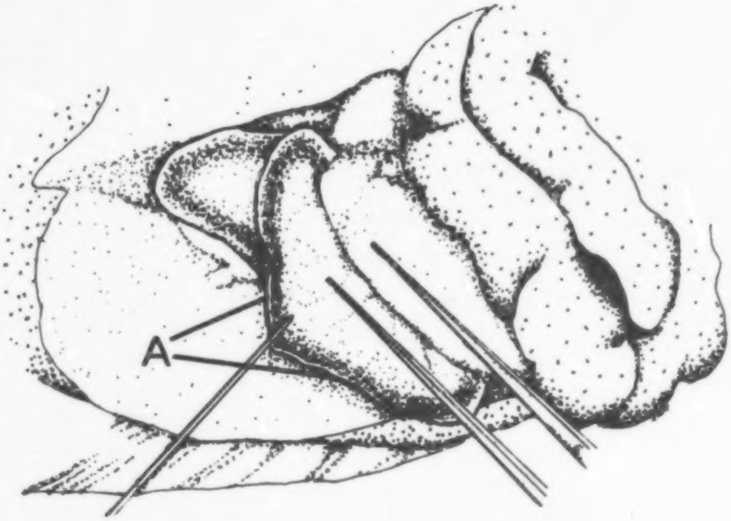


Fig. 12G. Maturing male plaice gonad that has had its leading edge (A) flipped up to show its sharp edge.

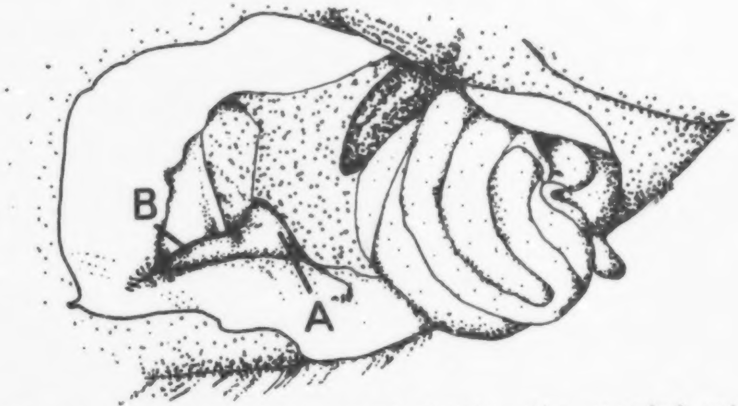


Fig. 12H. Immature female turbot gonad showing the rounded anterior edge (A) and the elongated posterior end (B).

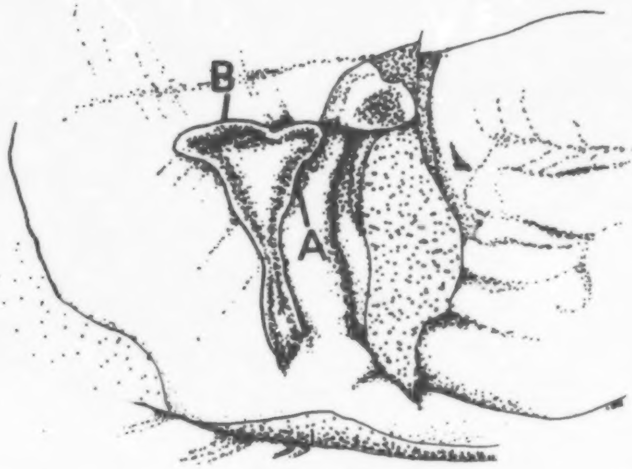


Fig. 12I. Immature male turbot gonad showing the sharp anterior edge (A) and the short posterior end (B).

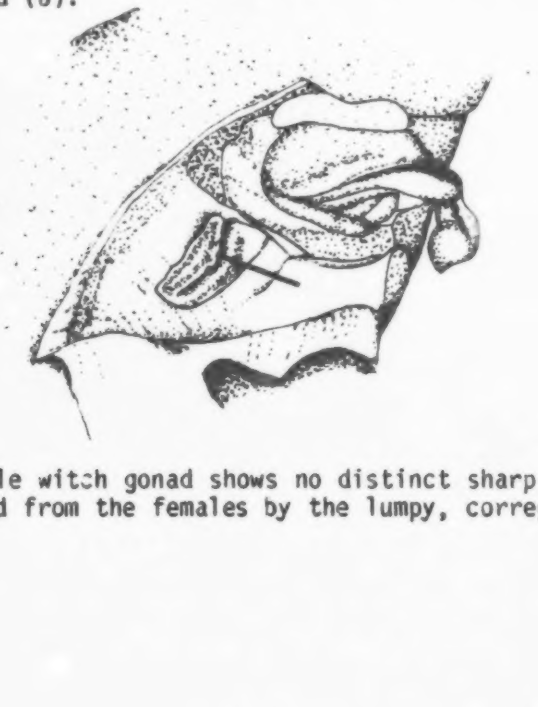


Fig. 12J. Maturing male witch gonad shows no distinct sharp leading edge, but can be distinuished from the females by the lumpy, corregated, and milty appearance.

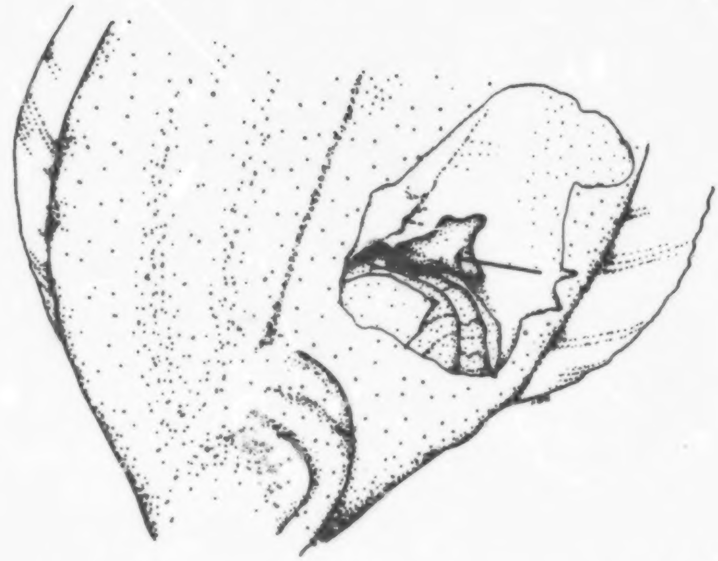


Fig. 12K. Maturing female witch gonad showing the rounded leading edge, the smooth appearance and a posteriorly produced end.

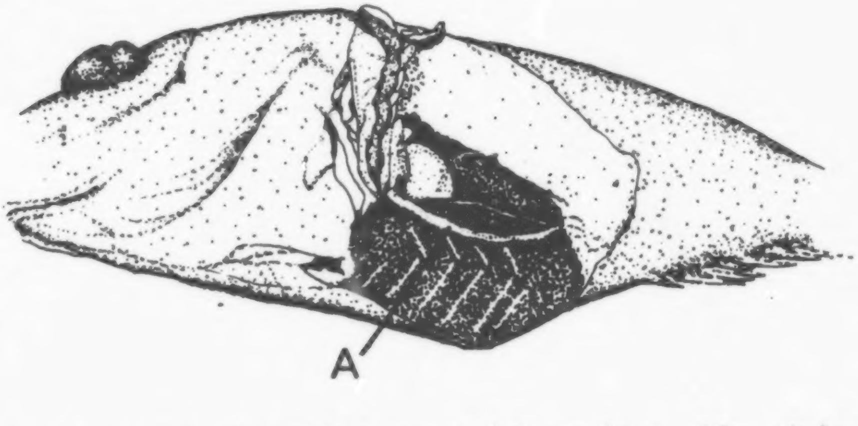


Fig. 12L. Immature male redfish gonads (A) are long, thin, string-like structures extending the length of the body cavity and imbedded in the intestinal mesentary. In the very immature they are very thin and difficult to locate.

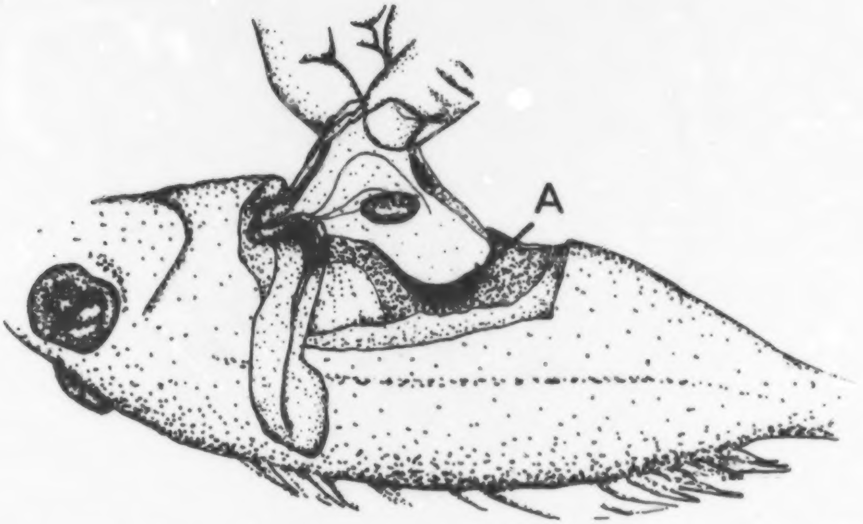


Fig. 12M. Immature female redfish gonad (A) are short, fat, baglike structures also imbedded in the intestinal mesentary.

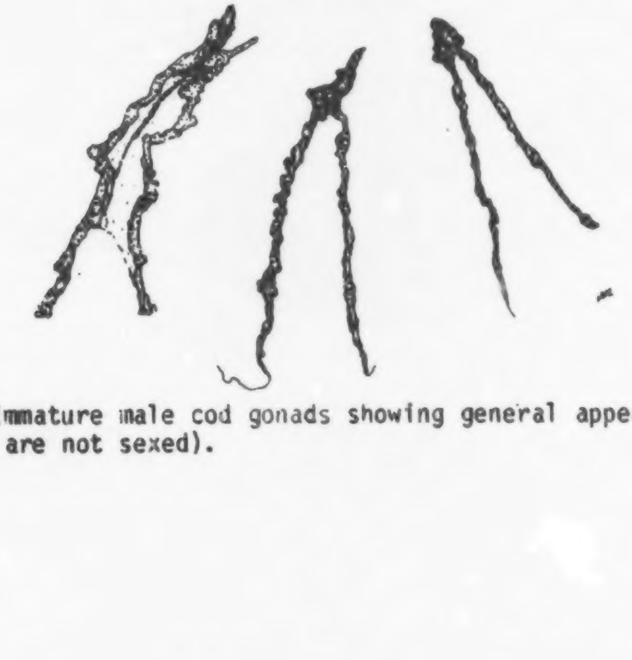


Fig. 12N. Immature male cod gonads showing general appearance of gadoid male gonads (cod are not sexed).

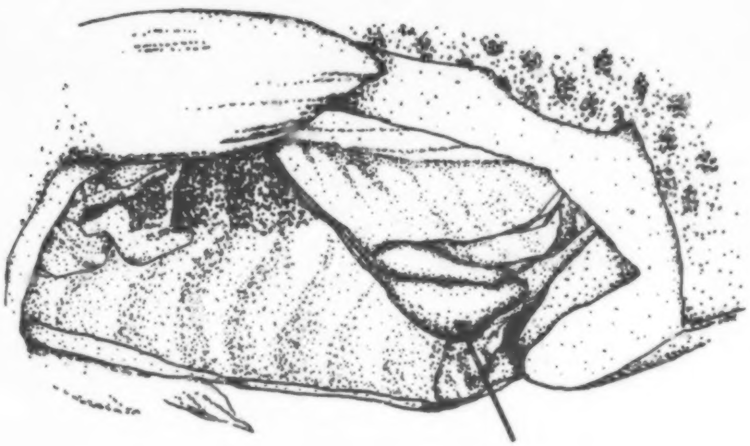


Fig. 12O. Immature female cod gonads showing the bag-like appearance generally seen in round fish.

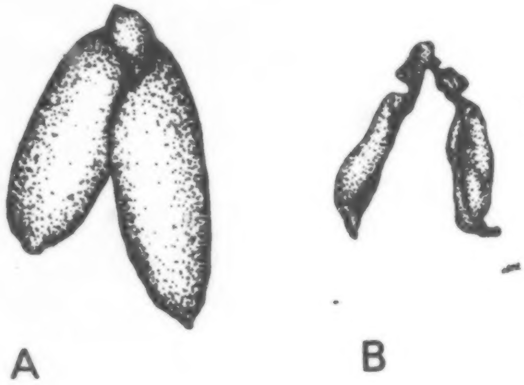


Fig. 12P. Maturing (A) and immature (B) grenadier (roughhead) female gonads showing the short bag-like appearance.

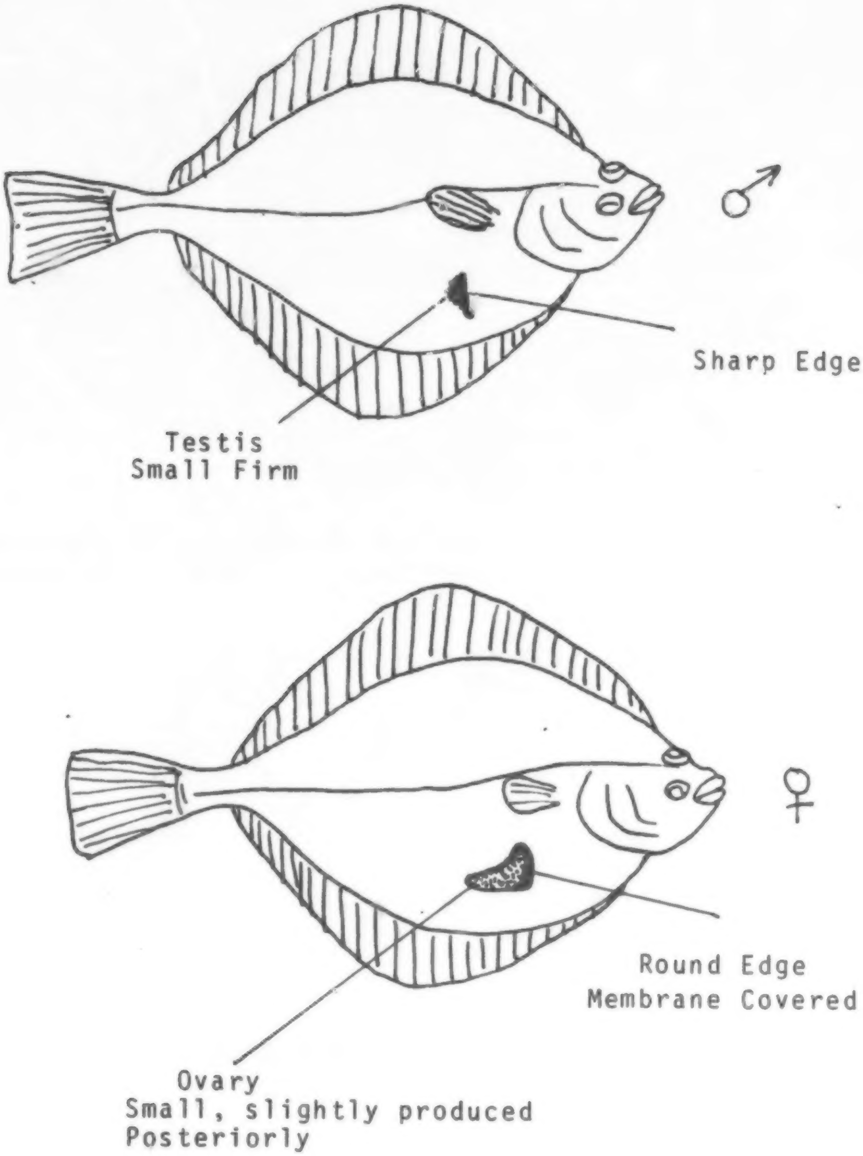


Fig.13a. Position of gonads in flatfish (Immature)

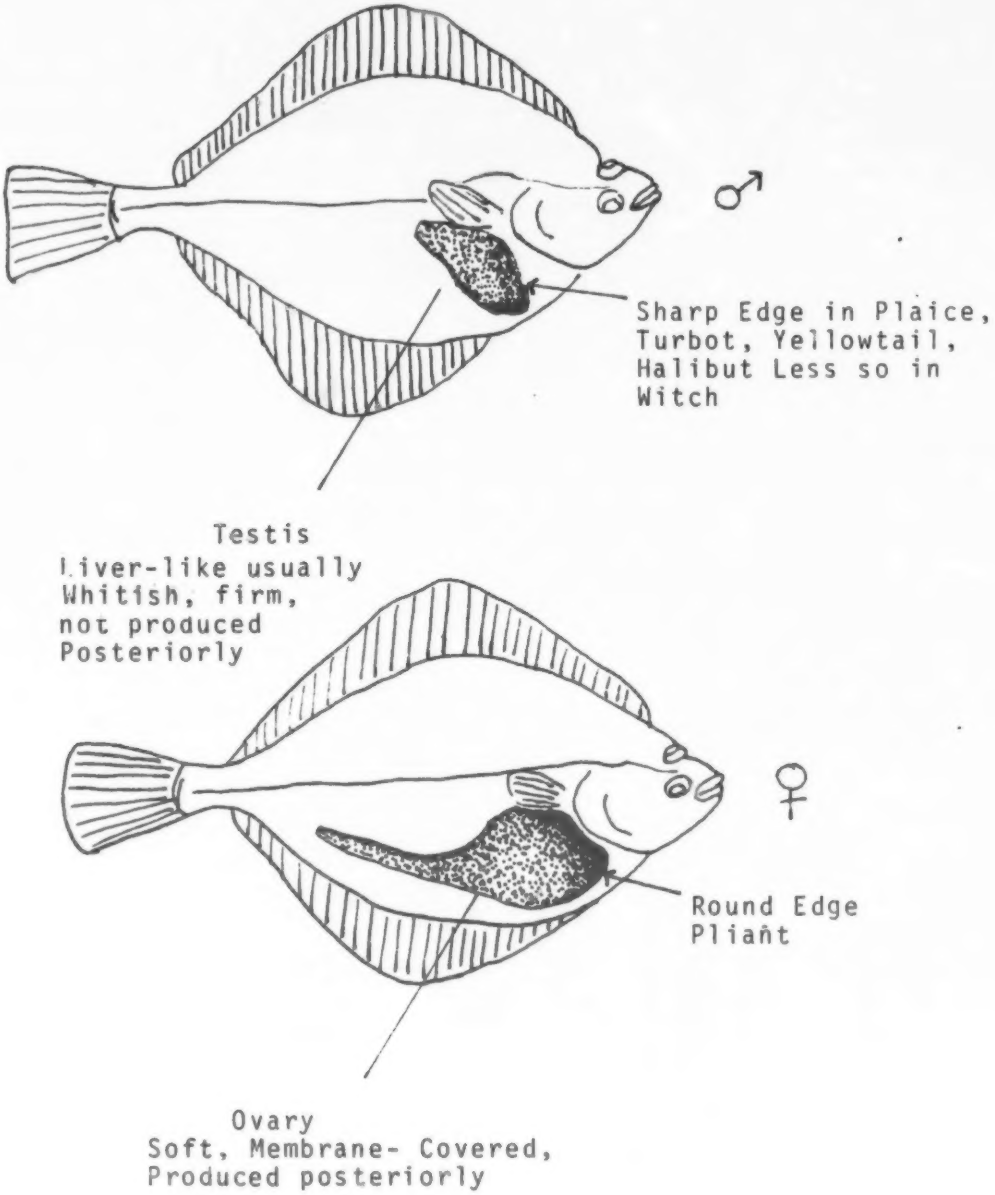
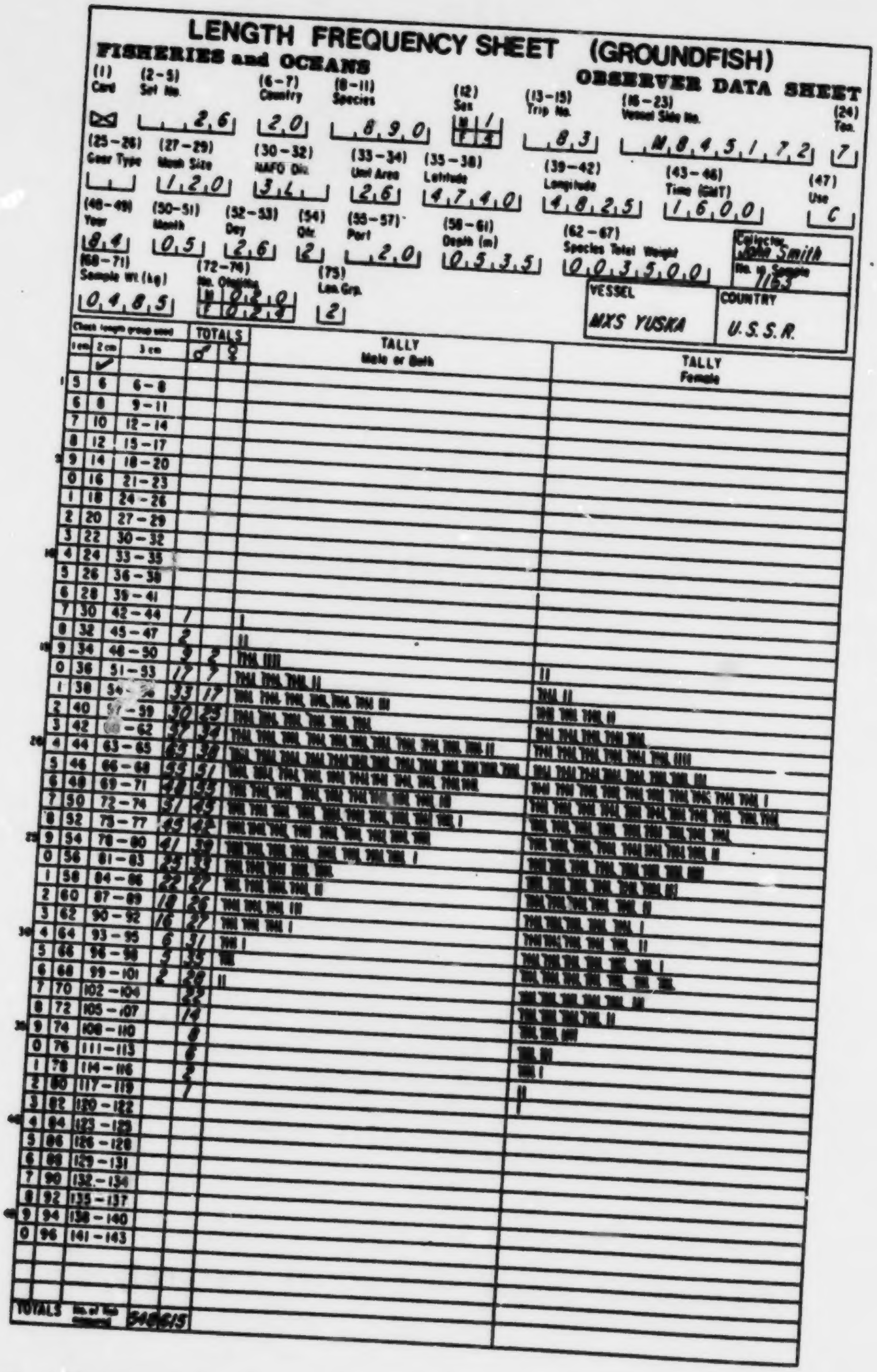

♂
Sharp Edge in Plaice, Turbot, Yellowtail, Halibut Less so in Witch
Testis
Liver-like usually Whitish, firm, not produced Posteriorly
♀
Round Edge Pliant
Ovary
Soft, Membrane- Covered, Produced posteriorly

Fig.13b. Position of gonads in flatfish (Mature)



LENGTH FREQUENCY SHEET (GROUNDFISH)

FISHERIES and OCEANS

OBSERVER DATA SHEET

(1) Card ☒
(2-5) Set No. 2,6
(6-7) Country 2,0
(8-11) Species 8,9,0
(12) Sex M 1 / F 2
(13-15) Trip No. 8,3
(16-23) Vessel Side No. M,8,4,5,1,7,2
(24) Ton. 7
(25-26) Gear Type
(27-29) Mesh Size 1,2,0
(30-32) NAFO Div. 3,L
(33-34) Unit Area 2,6
(35-38) Latitude 4,7,4,0
(39-42) Longitude 4,8,2,5
(43-46) Time (GMT) 1,6,0,0
(47) Use C
(48-49) Year 8,4
(50-51) Month 0,5
(52-53) Day 2,6
(54) Qtr. 2
(55-57) Port 2,0
(58-61) Depth (m) 0,5,3,5
(62-67) Species Total Weight 0,0,3,5,0,0
(68-71) Sample Wt (kg) 0,4,8,5
(72-74) No. Otoliths M 0,2,0 / F 0,2,4
(75) Len. Grp. 2
Collector John Smith
No. in Sample 1163
VESSEL MXS YUSKA
COUNTRY U.S.S.R.

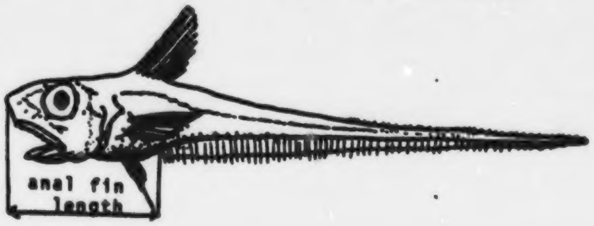
Check length group used			TOTALS	
1 cm	2 cm	3 cm	♂	♀
	✓			
5	6	6-8		
6	8	9-11		
7	10	12-14		
8	12	15-17		
9	14	18-20		
0	16	21-23		
1	18	24-26		
2	20	27-29		
3	22	30-32		
4	24	33-35		
5	26	36-38		
6	28	39-41		
7	30	42-44	1	
8	32	45-47	2	
9	34	48-50	9	2
0	36	51-53	17	7
1	38	54-56	33	17
2	40	57-59	30	25
3	42	60-62	57	34
4	44	63-65	65	32
5	46	66-68	55	51
6	48	69-71	48	35
7	50	72-74	57	45
8	52	75-77	55	42
9	54	78-80	41	39
0	56	81-83	25	33
1	58	84-86	22	27
2	60	87-89	18	26
3	62	90-92	16	27
4	64	93-95	6	31
5	66	96-98	3	33
6	68	99-101	2	28
7	70	102-104		22
8	72	105-107		14
9	74	108-110		8
0	76	111-113		6
1	78	114-116		2
2	80	117-119		1
3	82	120-122		
4	84	123-125		
5	86	126-128		
6	88	129-131		
7	90	132-134		
8	92	135-137		
9	94	138-140		
0	96	141-143		
TOTALS	No. of fish measured		546	615

TALLY Male or Both

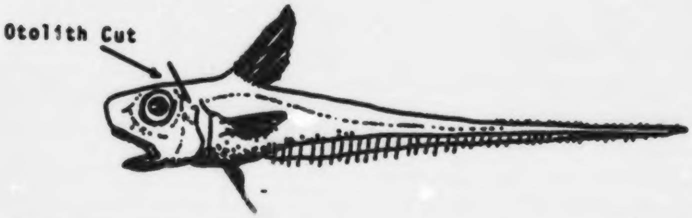
TALLY Female

Fig. 14. Observer Program length frequency sheet for groundfish.

Measuring ----Measure Anal Fin length as shown below



Otoliths ----Are taken as in other groundfish (as shown below)



Sexing -----Sexing is done in a manner similar to Redfish; because almost all Grenadiers are immature when caught therefore the gonads are small and difficult to sex. Position of gonads as below.

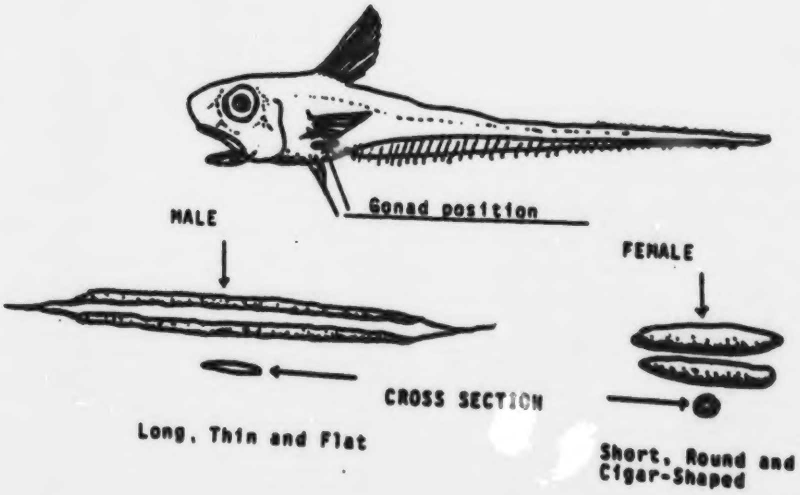
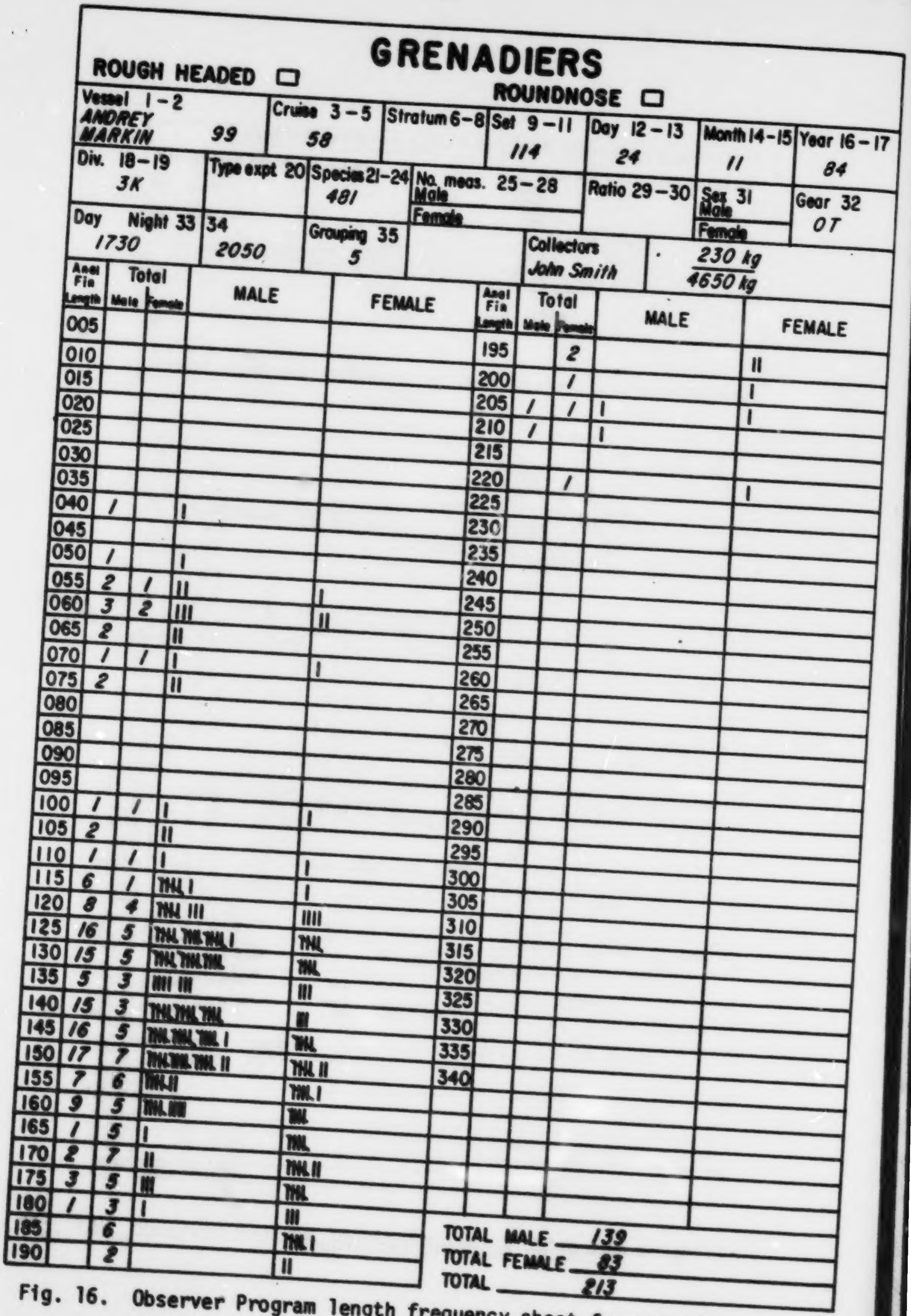


Fig. 15. Grenadier sampling techniques.



GRENADIERS

ROUGH HEADED ☐

ROUNDNOSE ☐

Vessel 1-2 ANDREY MARKIN 99	Cruise 3-5 58	Stratum 6-8	Set 9-11 114	Day 12-13 24	Month 14-15 11	Year 16-17 84
Div. 18-19 3K	Type expt 20	Species 21-24 481	No. meas. 25-28 Male Female	Ratio 29-30	Sex 31 Male Female	Gear 32 OT
Day Night 33 1730	34 2050	Grouping 35 5		Collectors John Smith	230 kg / 4650 kg	

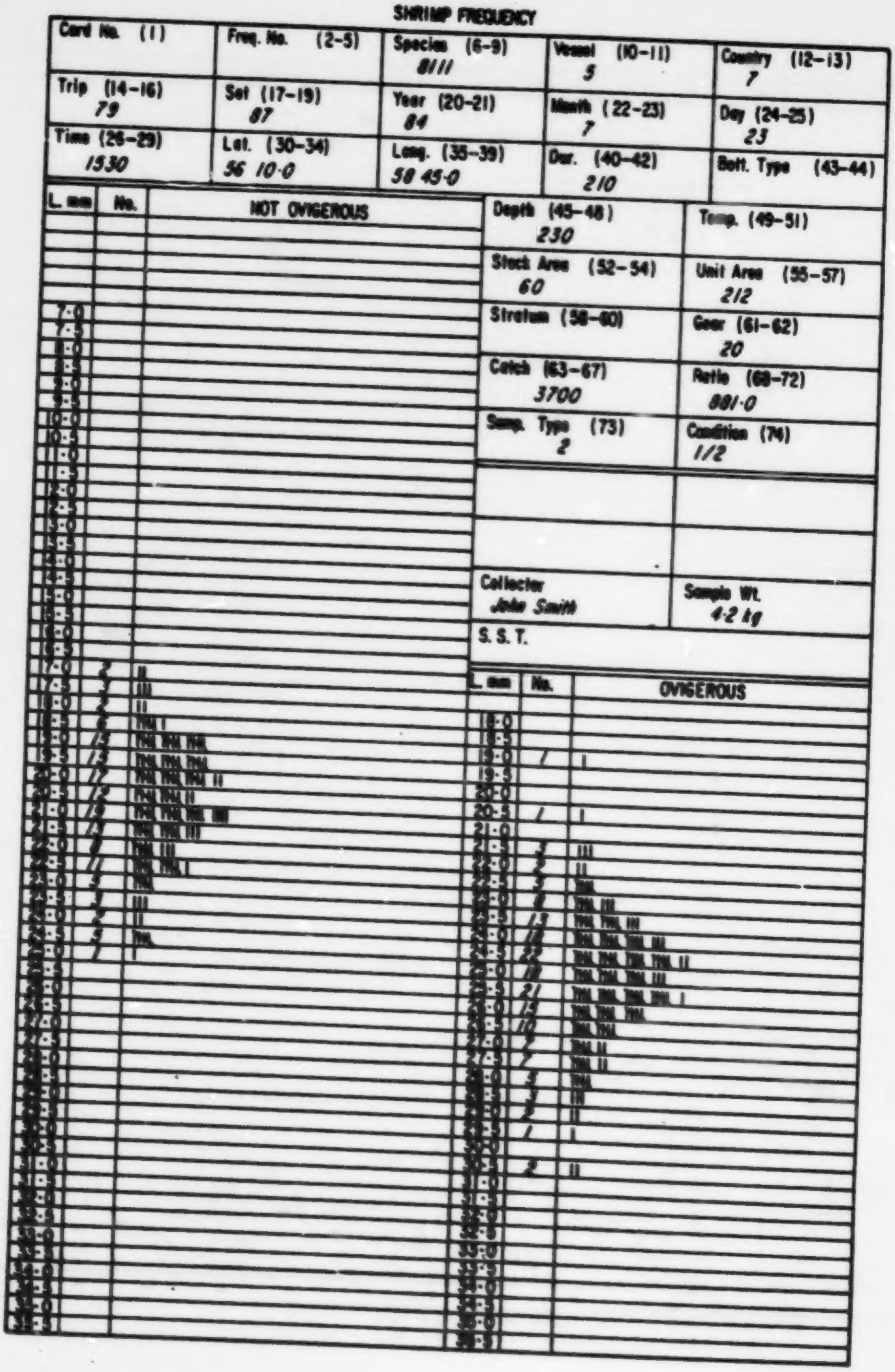
Anal Fin Length	Total Male	Total Female	MALE	FEMALE	Anal Fin Length	Total Male	Total Female	MALE	FEMALE
005					195		2		II
010					200		1		I
015					205	1	1	I	I
020					210	1		I	
025					215				
030					220		1		I
035					225				
040	1		I		230				
045					235				
050	1		I		240				
055	2	1	II	I	245				
060	3	2	III	II	250				
065	2		II		255				
070	1	1	I	I	260				
075	2		II		265				
080					270				
085					275				
090					280				
095					285				
100	1	1	I	I	290				
105	2		II		295				
110	1	1	I	I	300				
115	6	1	卌 I	I	305				
120	8	4	卌 III	IIII	310				
125	16	5	卌 卌 卌 I	卌	315				
130	15	5	卌 卌 卌	卌	320				
135	5	3	IIII III	III	325				
140	15	3	卌 卌 卌	III	330				
145	16	5	卌 卌 卌 I	卌	335				
150	17	7	卌 卌 卌 II	卌 II	340				
155	7	6	卌 II	卌 I					
160	9	5	卌 IIII	卌					
165	1	5	I	卌					
170	2	7	II	卌 II					
175	3	5	III	卌					
180	1	3	I	III					
185		6		卌 I					
190		2		II					

TOTAL MALE 139

TOTAL FEMALE 83

TOTAL 213

Fig. 16. Observer Program length frequency sheet for grenadiers.



SHRIMP FREQUENCY

Card No. (1)	Freq. No. (2-5)	Species (6-9) 8111	Vessel (10-11) 5	Country (12-13) 7
Trip (14-16) 79	Set (17-19) 87	Year (20-21) 84	Month (22-23) 7	Day (24-25) 23
Time (26-29) 1530	Lat. (30-34) 56 10·0	Long. (35-39) 58 45·0	Dur. (40-42) 210	Bott. Type (43-44)

Depth (45-48) 230	Temp. (49-51)
Stock Area (52-54) 60	Unit Area (55-57) 212
Stratum (58-60)	Gear (61-62) 20
Catch (63-67) 3700	Ratio (68-72) 881·0
Samp. Type (73) 2	Condition (74) 1/2
Collector John Smith	Sample Wt. 4·2 kg
S. S. T.	

L. mm	No.	NOT OVIGEROUS
7·0		
7·5		
8·0		
8·5		
9·0		
9·5		
10·0		
10·5		
11·0		
11·5		
12·0		
12·5		
13·0		
13·5		
14·0		
14·5		
15·0		
15·5		
16·0		
16·5		
17·0	2	II
17·5	3	III
18·0	2	II
18·5	6	𝍸 I
19·0	15	𝍸 𝍸 𝍸
19·5	15	𝍸 𝍸 𝍸
20·0	17	𝍸 𝍸 𝍸 II
20·5	12	𝍸 𝍸 II
21·0	19	𝍸 𝍸 𝍸 IIII
21·5	13	𝍸 𝍸 III
22·0	8	𝍸 III
22·5	11	𝍸 𝍸 I
23·0	5	𝍸
23·5	3	III
24·0	2	II
24·5	5	𝍸
25·0	1	I
25·5		
26·0		
26·5		
27·0		
27·5		
28·0		
28·5		
29·0		
29·5		
30·0		
30·5		
31·0		
31·5		
32·0		
32·5		
33·0		
33·5		
34·0		
34·5		
35·0		
35·5		
36·0		
36·5		

L. mm	No.	OVIGEROUS
18·0		
18·5		
19·0	1	I
19·5		
20·0		
20·5	1	I
21·0		
21·5	3	III
22·0	2	II
22·5	5	𝍸
23·0	8	𝍸 III
23·5	13	𝍸 𝍸 III
24·0	18	𝍸 𝍸 𝍸 III
24·5	22	𝍸 𝍸 𝍸 𝍸 II
25·0	18	𝍸 𝍸 𝍸 III
25·5	21	𝍸 𝍸 𝍸 𝍸 I
26·0	15	𝍸 𝍸 𝍸
26·5	10	𝍸 𝍸
27·0	7	𝍸 II
27·5	7	𝍸 II
28·0	5	𝍸
28·5	3	III
29·0	2	II
29·5	1	I
30·0		
30·5	2	II
31·0		
31·5		
32·0		
32·5		
33·0		
33·5		
34·0		
34·5		
35·0		
35·5		
36·0		
36·5		

Fig. 17. Observer Program length frequency sheet for shrimp.

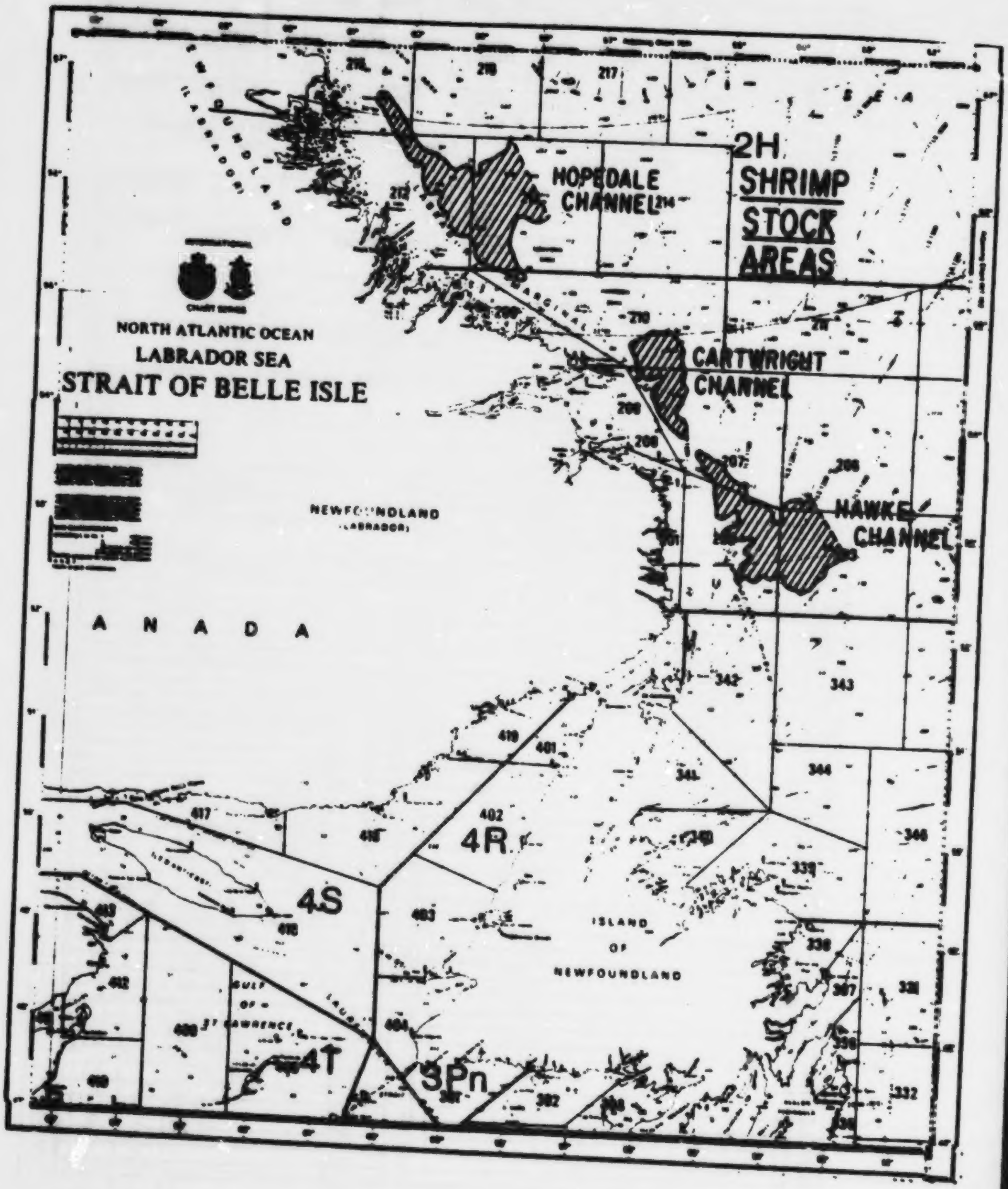


Fig. 18. Shrimp stock areas (Labrador).

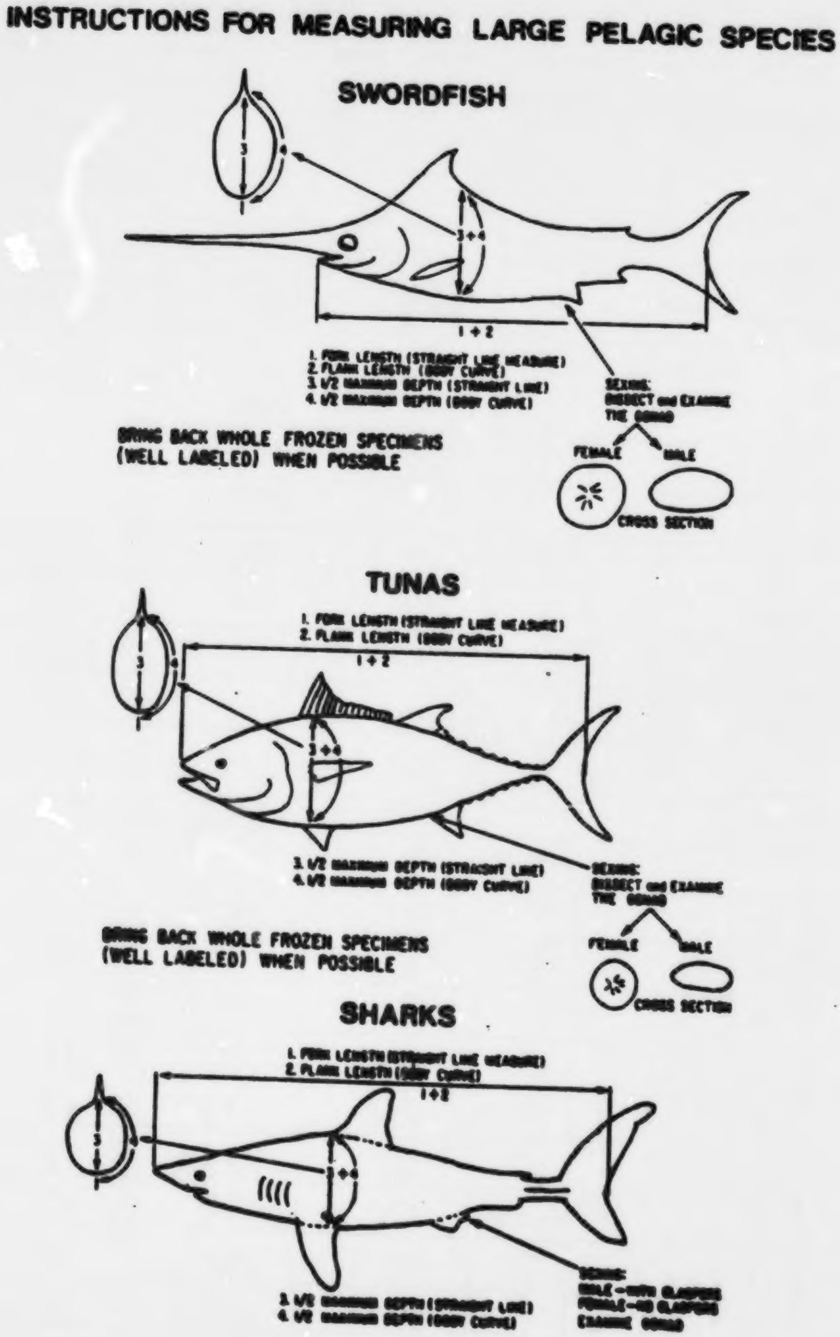
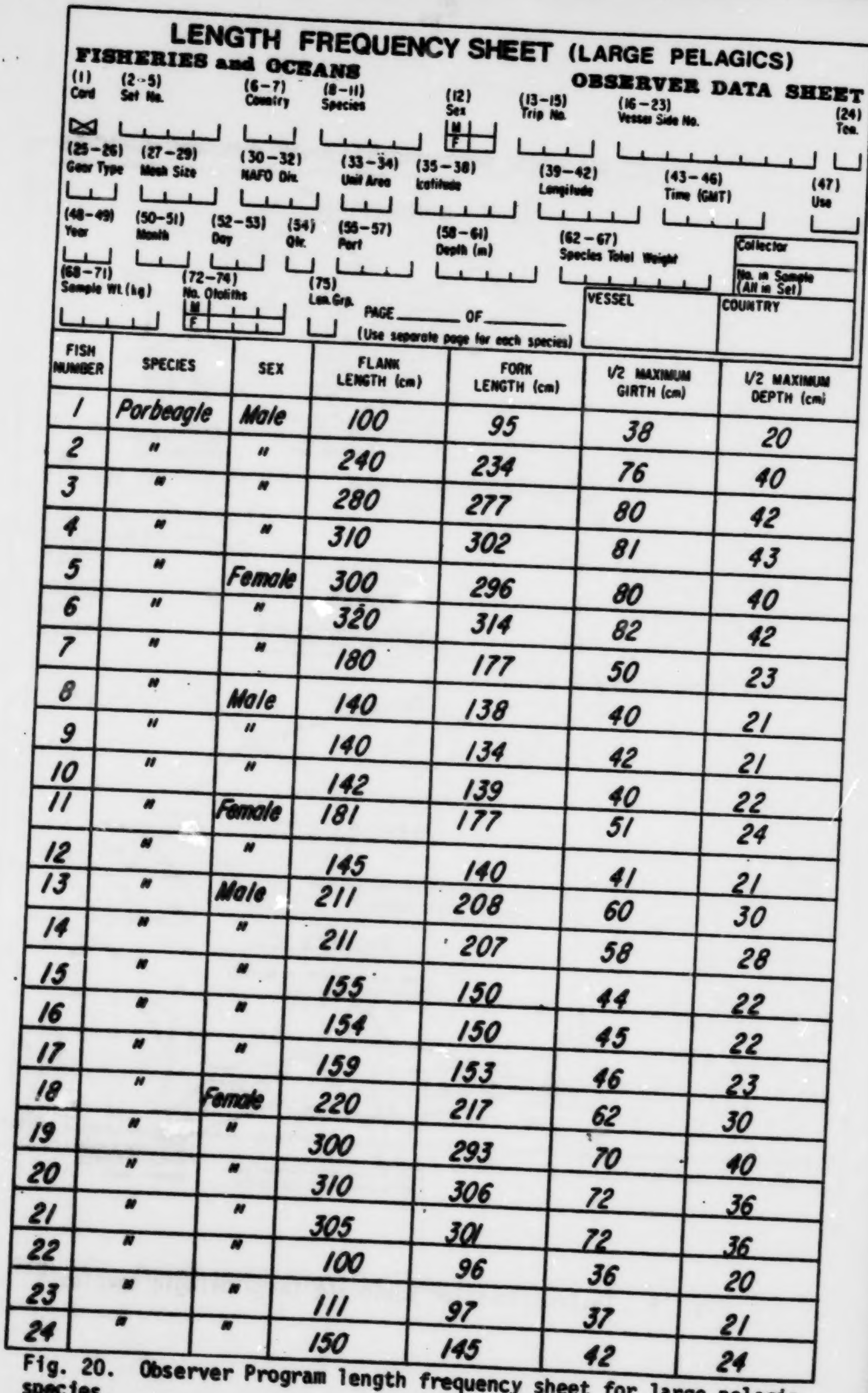

INSTRUCTIONS FOR MEASURING LARGE PELAGIC SPECIES
SWORDFISH
3
4
3+4
1+2
1. FORK LENGTH (STRAIGHT LINE MEASURE)
2. FLANK LENGTH (BODY CURVE)
3. 1/2 MAXIMUM DEPTH (STRAIGHT LINE)
4. 1/2 MAXIMUM DEPTH (BODY CURVE)
SEXING:
BISECT and EXAMINE
THE GONAD
FEMALE
MALE
CROSS SECTION
BRING BACK WHOLE FROZEN SPECIMENS
(WELL LABELED) WHEN POSSIBLE
TUNAS
1. FORK LENGTH (STRAIGHT LINE MEASURE)
2. FLANK LENGTH (BODY CURVE)
1+2
3
4
3+4
3. 1/2 MAXIMUM DEPTH (STRAIGHT LINE)
4. 1/2 MAXIMUM DEPTH (BODY CURVE)
SEXING:
BISECT and EXAMINE
THE GONAD
FEMALE
MALE
CROSS SECTION
BRING BACK WHOLE FROZEN SPECIMENS
(WELL LABELED) WHEN POSSIBLE
SHARKS
1. FORK LENGTH (STRAIGHT LINE MEASURE)
2. FLANK LENGTH (BODY CURVE)
1+2
3
3+4
3. 1/2 MAXIMUM DEPTH (STRAIGHT LINE)
4. 1/2 MAXIMUM DEPTH (BODY CURVE)
SEXING:
MALE—WITH CLASPERS
FEMALE—NO CLASPERS
EXAMINE GONAD

Fig. 19. Instructions for measuring large pelagic species.



LENGTH FREQUENCY SHEET (LARGE PELAGICS)

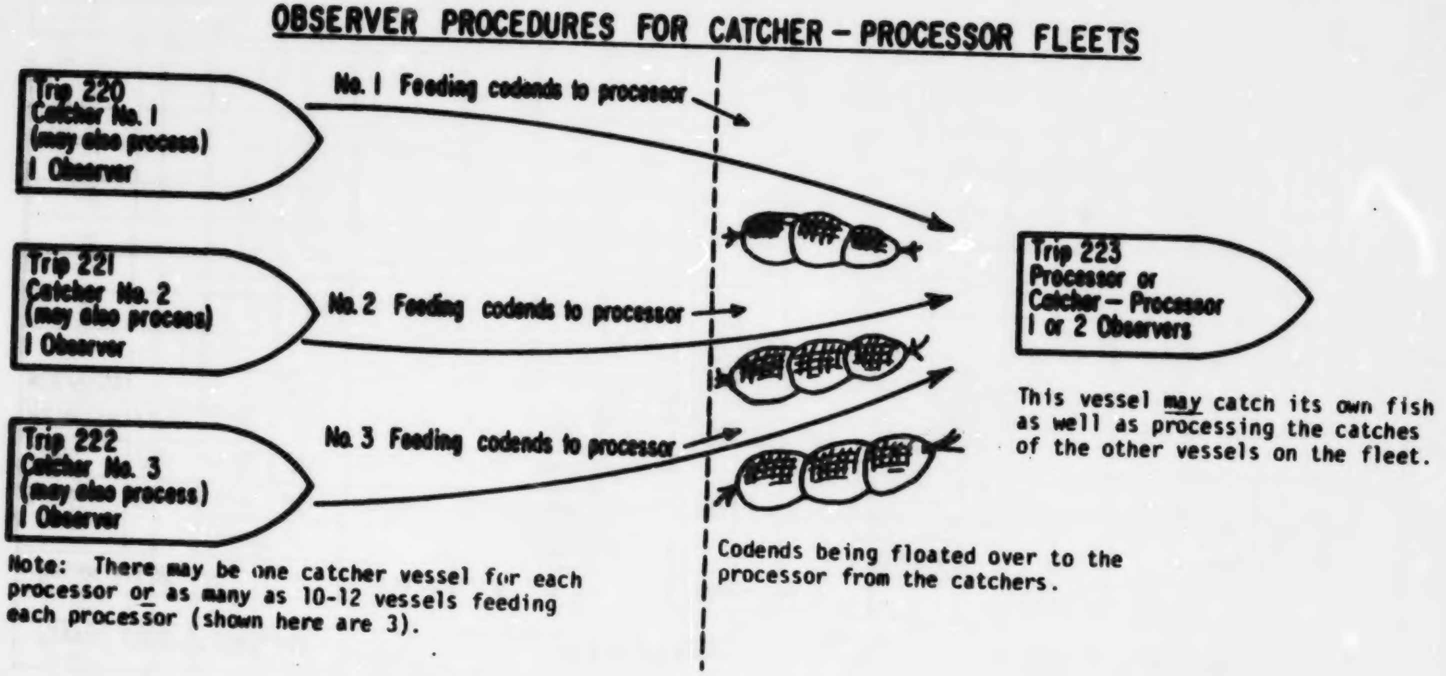
FISHERIES and OCEANS

OBSERVER DATA SHEET

(1) Card ☒
(2-5) Set No.
(6-7) Country
(8-11) Species
(12) Sex M F
(13-15) Trip No.
(16-23) Vessel Side No.
(24) Ton.
(25-26) Gear Type
(27-29) Mesh Size
(30-32) NAFO Div.
(33-34) Unit Area
(35-38) Latitude
(39-42) Longitude
(43-46) Time (GMT)
(47) Use
(48-49) Year
(50-51) Month
(52-53) Day
(54) Qtr.
(55-57) Port
(58-61) Depth (m)
(62-67) Species Total Weight
Collector
No. in Sample (All in Set)
(68-71) Sample Wt. (kg)
(72-74) No. Otoliths M F
(75) Len. Grp.
PAGE ______ OF ______
(Use separate page for each species)
VESSEL
COUNTRY

FISH NUMBER	SPECIES	SEX	FLANK LENGTH (cm)	FORK LENGTH (cm)	1/2 MAXIMUM GIRTH (cm)	1/2 MAXIMUM DEPTH (cm)
1	Porbeagle	Male	100	95	38	20
2	"	"	240	234	76	40
3	"	"	280	277	80	42
4	"	"	310	302	81	43
5	"	Female	300	296	80	40
6	"	"	320	314	82	42
7	"	"	180	177	50	23
8	"	Male	140	138	40	21
9	"	"	140	134	42	21
10	"	"	142	139	40	22
11	"	Female	181	177	51	24
12	"	"	145	140	41	21
13	"	Male	211	208	60	30
14	"	"	211	207	58	28
15	"	"	155	150	44	22
16	"	"	154	150	45	22
17	"	"	159	153	46	23
18	"	Female	220	217	62	30
19	"	"	300	293	70	40
20	"	"	310	306	72	36
21	"	"	305	301	72	36
22	"	"	100	96	36	20
23	"	"	111	97	37	21
24	"	"	150	145	42	24

Fig. 20. Observer Program length frequency sheet for large pelagic species.



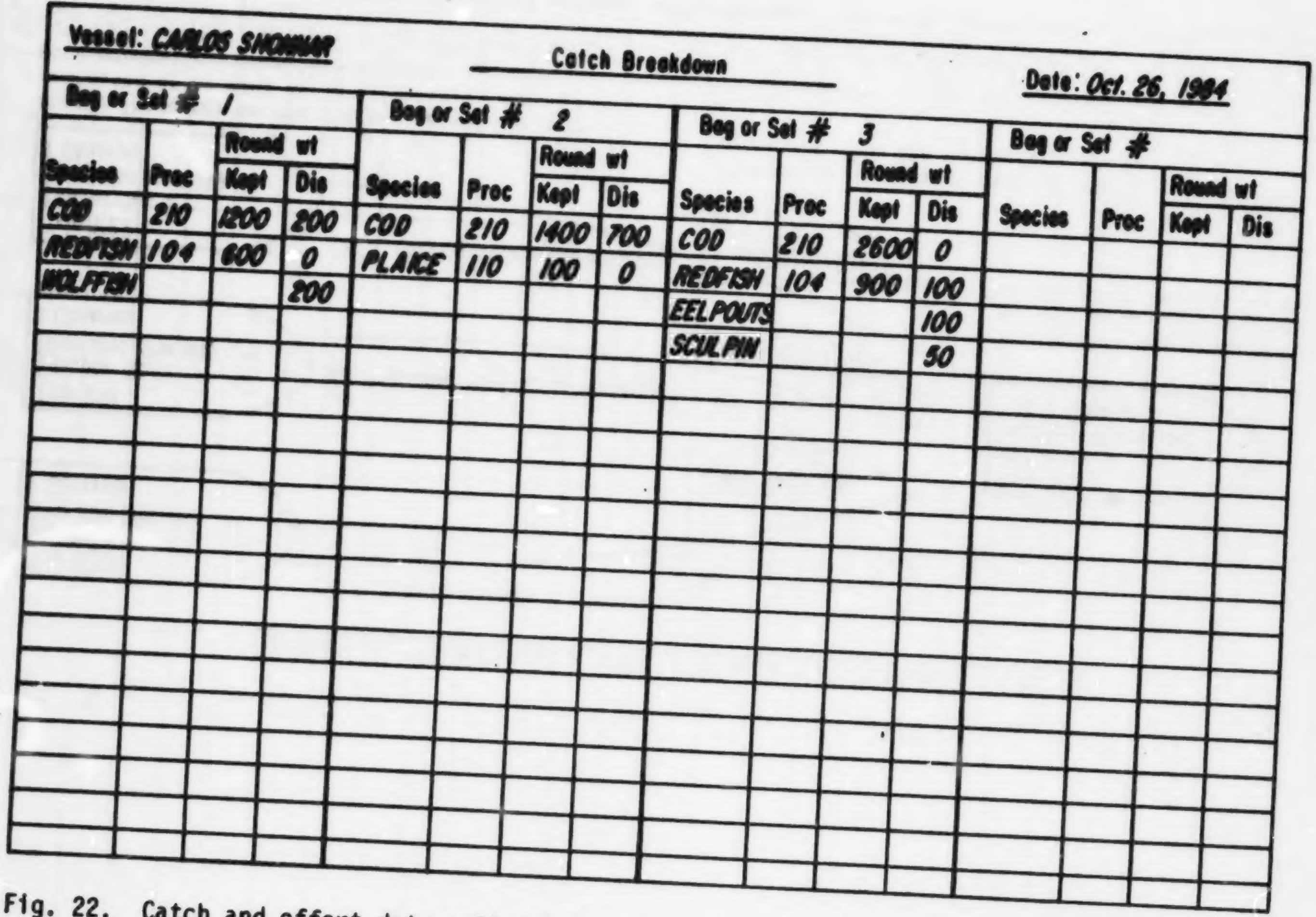
OBSERVER PROCEDURES FOR CATCHER – PROCESSOR FLEETS

This vessel may catch its own fish as well as processing the catches of the other vessels on the fleet.

Codends being floated over to the processor from the catchers.

Note: There may be one catcher vessel for each processor or as many as 10-12 vessels feeding each processor (shown here are 3).

Fig. 21. Catcher-processor data collection methodology.



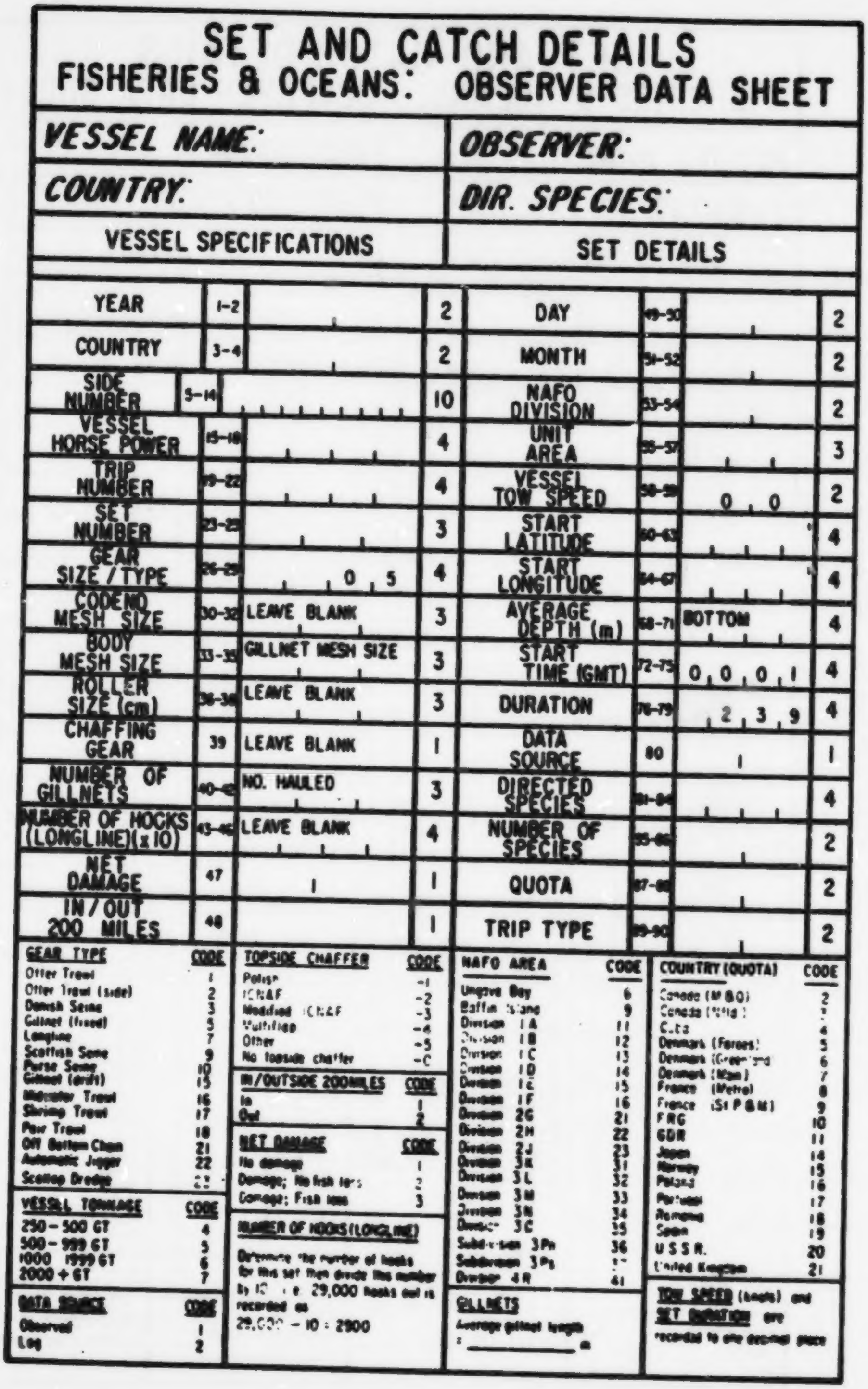
Vessel: *CARLOS SHONNAR*

Catch Breakdown

Date: *Oct. 26, 1984*

Bag or Set # 1				Bag or Set # 2				Bag or Set # 3				Bag or Set #			
Species	Proc	Round wt		Species	Proc	Round wt		Species	Proc	Round wt		Species	Proc	Round wt	
		Kept	Dis			Kept	Dis			Kept	Dis			Kept	Dis
COD	210	1200	200	COD	210	1400	700	COD	210	2600	0				
REDFISH	104	600	0	PLAICE	110	100	0	REDFISH	104	900	100				
WOLFFISH			200					EELPOUTS			100				
								SCULPIN			50				

Fig. 22. Catch and effort data collection form for use on processing vessels.



SET AND CATCH DETAILS
FISHERIES & OCEANS: OBSERVER DATA SHEET

VESSEL NAME:	*OBSERVER:*
COUNTRY:	*DIR. SPECIES:*
VESSEL SPECIFICATIONS	SET DETAILS

YEAR	1-2		2	DAY	49-50		2
COUNTRY	3-4		2	MONTH	51-52		2
SIDE NUMBER	5-14		10	NAFO DIVISION	53-54		2
VESSEL HORSE POWER	15-18		4	UNIT AREA	55-57		3
TRIP NUMBER	19-22		4	VESSEL TOW SPEED	58-59	0 0	2
SET NUMBER	23-25		3	START LATITUDE	60-63		4
GEAR SIZE / TYPE	26-29	0 5	4	START LONGITUDE	64-67		4
CODEND MESH SIZE	30-32	LEAVE BLANK	3	AVERAGE DEPTH (m)	68-71	BOTTOM	4
BODY MESH SIZE	33-35	GILLNET MESH SIZE	3	START TIME (GMT)	72-75	0 0 0 1	4
ROLLER SIZE (cm)	36-38	LEAVE BLANK	3	DURATION	76-79	2 3 9	4
CHAFFING GEAR	39	LEAVE BLANK	1	DATA SOURCE	80	1	1
NUMBER OF GILLNETS	40-42	NO. HAULED	3	DIRECTED SPECIES	81-84		4
NUMBER OF HOOKS (LONGLINE)(x10)	43-46	LEAVE BLANK	4	NUMBER OF SPECIES	85-86		2
NET DAMAGE	47	1	1	QUOTA	87-88		2
IN/OUT 200 MILES	48		1	TRIP TYPE	89-90		2

GEAR TYPE	CODE
Otter Trawl	1
Otter Trawl (side)	2
Danish Seine	3
Gillnet (fixed)	5
Longline	7
Scottish Seine	9
Purse Seine	10
Gillnet (drift)	15
Midwater Trawl	16
Shrimp Trawl	17
Pair Trawl	18
Off Bottom Chain	21
Automatic Jigger	22
Scallop Dredge	23

VESSEL TONNAGE	CODE
250 – 500 GT	4
500 – 999 GT	5
1000 1999 GT	6
2000 + GT	7

DATA SOURCE	CODE
Observed	1
Log	2

TOPSIDE CHAFFER	CODE
Polish	-1
ICNAF	-2
Modified ICNAF	-3
Multiflap	-4
Other	-5
No topside chaffer	-C

IN/OUTSIDE 200MILES	CODE
In	1
Out	2

NET DAMAGE	CODE
No damage	1
Damage; No fish loss	2
Damage; Fish loss	3

NUMBER OF HOOKS (LONGLINE)

Determine the number of hooks for this set then divide this number by 10 i.e. 29,000 hooks out is recorded as
29,000 – 10 = 2900

NAFO AREA	CODE
Ungava Bay	6
Baffin Island	9
Division 1A	11
Division 1B	12
Division 1C	13
Division 1D	14
Division 1E	15
Division 1F	16
Division 2G	21
Division 2H	22
Division 2J	23
Division 3K	31
Division 3L	32
Division 3M	33
Division 3N	34
Division 3O	35
Subdivision 3Pn	36
Subdivision 3Ps	37
Division 4R	41

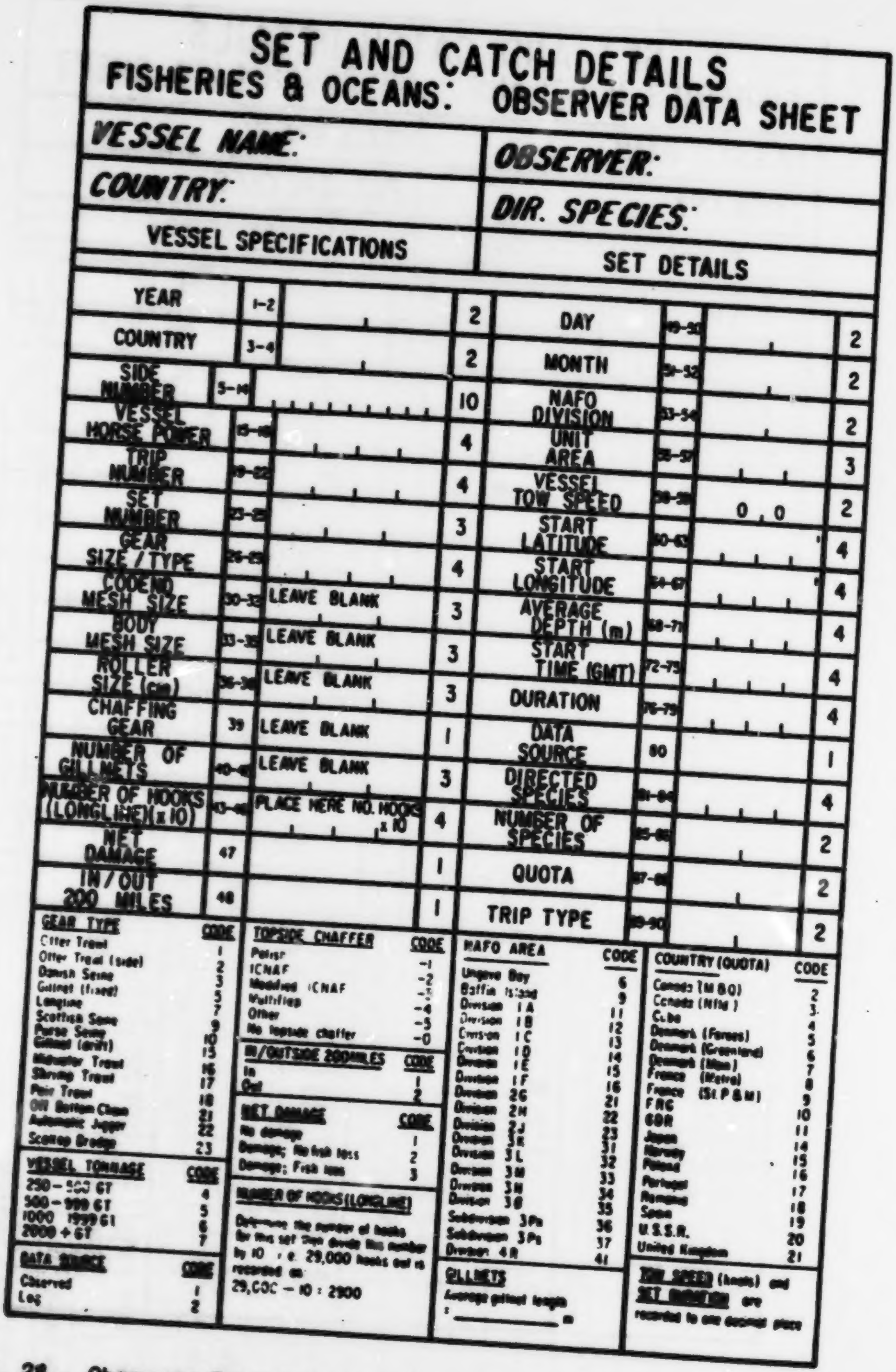
GILLNETS

Average gillnet length
= ____________ m

COUNTRY (QUOTA)	CODE
Canada (M.B.O.)	2
Canada (Nfld.)	3
Cuba	4
Denmark (Faroes)	5
Denmark (Greenland)	6
Denmark (Main)	7
France (Metro)	8
France (St P & M)	9
FRG	10
GDR	11
Japan	14
Norway	15
Poland	16
Portugal	17
Romania	18
Spain	19
U.S.S.R.	20
United Kingdom	21

TOW SPEED (knots) and SET DURATION are recorded to one decimal place

Fig. 23. Observer Program set and catch detail sheet with categories modified for gillnet trips.



SET AND CATCH DETAILS

FISHERIES & OCEANS: OBSERVER DATA SHEET

VESSEL NAME:	*OBSERVER:*
COUNTRY:	*DIR. SPECIES:*

VESSEL SPECIFICATIONS				SET DETAILS			
YEAR	1-2		2	DAY	49-50		2
COUNTRY	3-4		2	MONTH	51-52		2
SIDE NUMBER	5-14		10	NAFO DIVISION	53-54		2
VESSEL HORSE POWER	15-18		4	UNIT AREA	55-57		3
TRIP NUMBER	19-22		4	VESSEL TOW SPEED	58-59	0 , 0	2
SET NUMBER	23-25		3	START LATITUDE	60-63		4
GEAR SIZE / TYPE	26-29		4	START LONGITUDE	64-67		4
CODEND MESH SIZE	30-32	LEAVE BLANK	3	AVERAGE DEPTH (m)	68-71		4
BODY MESH SIZE	33-35	LEAVE BLANK	3	START TIME (GMT)	72-75		4
ROLLER SIZE (cm)	36-38	LEAVE BLANK	3	DURATION	76-79		4
CHAFFING GEAR	39	LEAVE BLANK	1	DATA SOURCE	80		1
NUMBER OF GILLNETS	40-42	LEAVE BLANK	3	DIRECTED SPECIES	81-84		4
NUMBER OF HOOKS (LONGLINE)(x 10)	43-46	PLACE HERE NO. HOOKS x 10	4	NUMBER OF SPECIES	85-86		2
NET DAMAGE	47		1	QUOTA	87-88		2
IN/OUT 200 MILES	48		1	TRIP TYPE	89-90		2

GEAR TYPE	CODE
Otter Trawl	1
Otter Trawl (side)	2
Danish Seine	3
Gillnet (fixed)	5
Longline	7
Scottish Seine	9
Purse Seine	10
Gillnet (drift)	15
Midwater Trawl	16
Shrimp Trawl	17
Pair Trawl	18
Off Bottom Clam	21
Automatic Jigger	22
Scallop Dredge	23

VESSEL TONNAGE	CODE
250 - 500 GT	4
500 - 999 GT	5
1000 - 1999 GT	6
2000 + GT	7

DATA SOURCE	CODE
Observed	1
Log	2

TOPSIDE CHAFFER	CODE
Polish	-1
ICNAF	-2
Modified ICNAF	-3
Multiflap	-4
Other	-5
No topside chaffer	-0

IN/OUTSIDE 200MILES	CODE
In	1
Out	2

NET DAMAGE	CODE
No damage	1
Damage; No fish loss	2
Damage; Fish loss	3

NUMBER OF HOOKS (LONGLINE)

Determine the number of hooks for this set then divide this number by 10 i.e. 29,000 hooks out is recorded as:

29,000 ÷ 10 = 2900

NAFO AREA	CODE
Ungava Bay	6
Baffin Island	9
Division 1A	11
Division 1B	12
Division 1C	13
Division 1D	14
Division 1E	15
Division 1F	16
Division 2G	21
Division 2H	22
Division 2J	23
Division 3K	31
Division 3L	32
Division 3M	33
Division 3N	34
Division 3O	35
Subdivision 3Pn	36
Subdivision 3Ps	37
Division 4R	41

GILLNETS

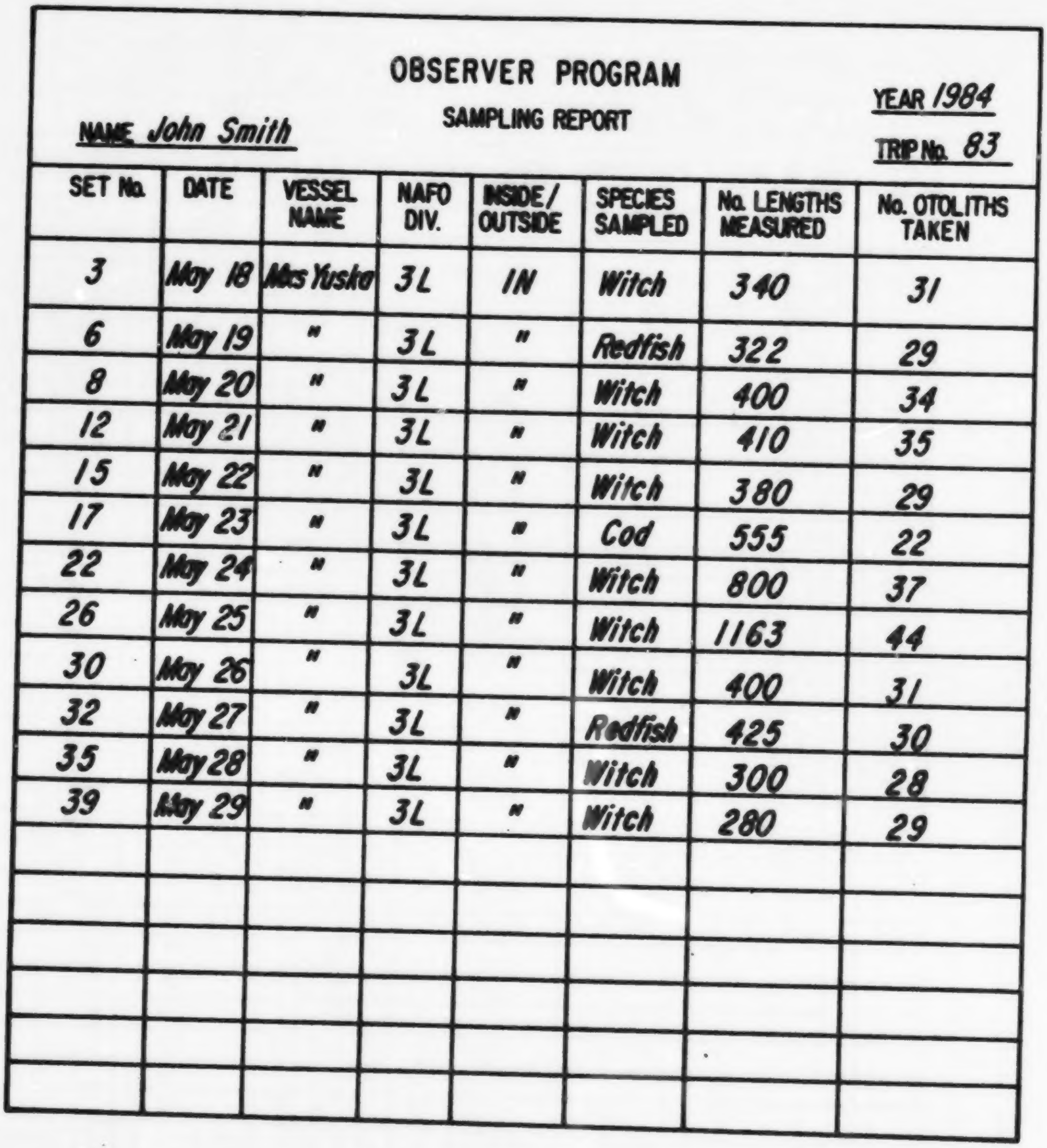
Average gillnet length

= __________ m

COUNTRY (QUOTA)	CODE
Canada (M & Q)	2
Canada (Nfld.)	3
Cuba	4
Denmark (Faroes)	5
Denmark (Greenland)	6
Denmark (Main)	7
France (Metro)	8
France (St P & M)	9
FRG	10
GDR	11
Japan	14
Norway	15
Poland	16
Portugal	17
Romania	18
Spain	19
U.S.S.R.	20
United Kingdom	21

TOW SPEED (knots) and SET DURATION are recorded to one decimal place

Fig. 2A.. Observer Program set and catch detail sheet with categories modified for longliner trips.



OBSERVER PROGRAM

SAMPLING REPORT

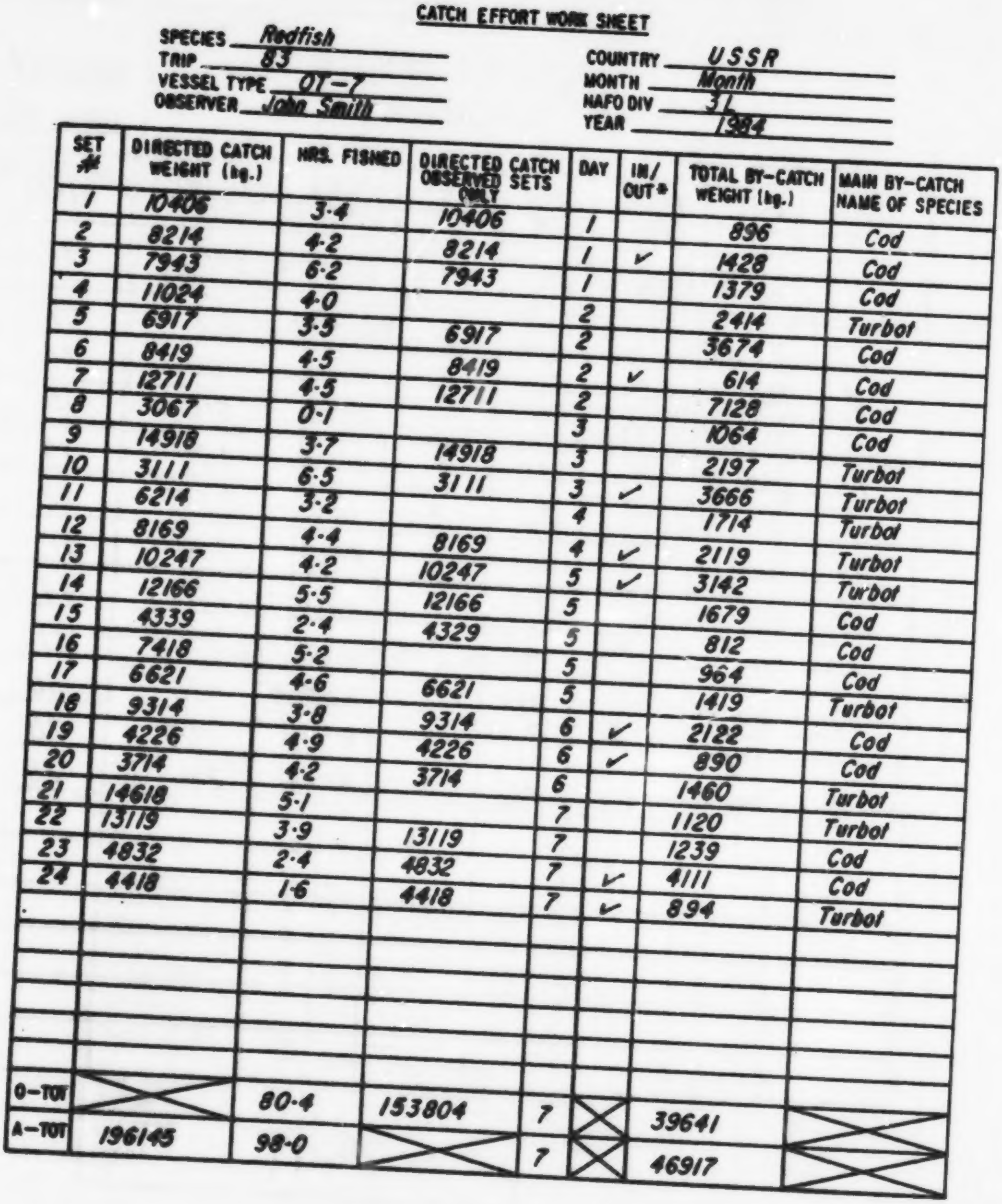
NAME John Smith

YEAR 1984

TRIP No. 83

SET No.	DATE	VESSEL NAME	NAFO DIV.	INSIDE/ OUTSIDE	SPECIES SAMPLED	No. LENGTHS MEASURED	No. OTOLITHS TAKEN
3	May 18	Mrs Yuska	3L	IN	Witch	340	31
6	May 19	"	3L	"	Redfish	322	29
8	May 20	"	3L	"	Witch	400	34
12	May 21	"	3L	"	Witch	410	35
15	May 22	"	3L	"	Witch	380	29
17	May 23	"	3L	"	Cod	555	22
22	May 24	"	3L	"	Witch	800	37
26	May 25	"	3L	"	Witch	1163	44
30	May 26	"	3L	"	Witch	400	31
32	May 27	"	3L	"	Redfish	425	30
35	May 28	"	3L	"	Witch	300	28
39	May 29	"	3L	"	Witch	280	29

Fig. 25. Observer Program sampling report sheet.

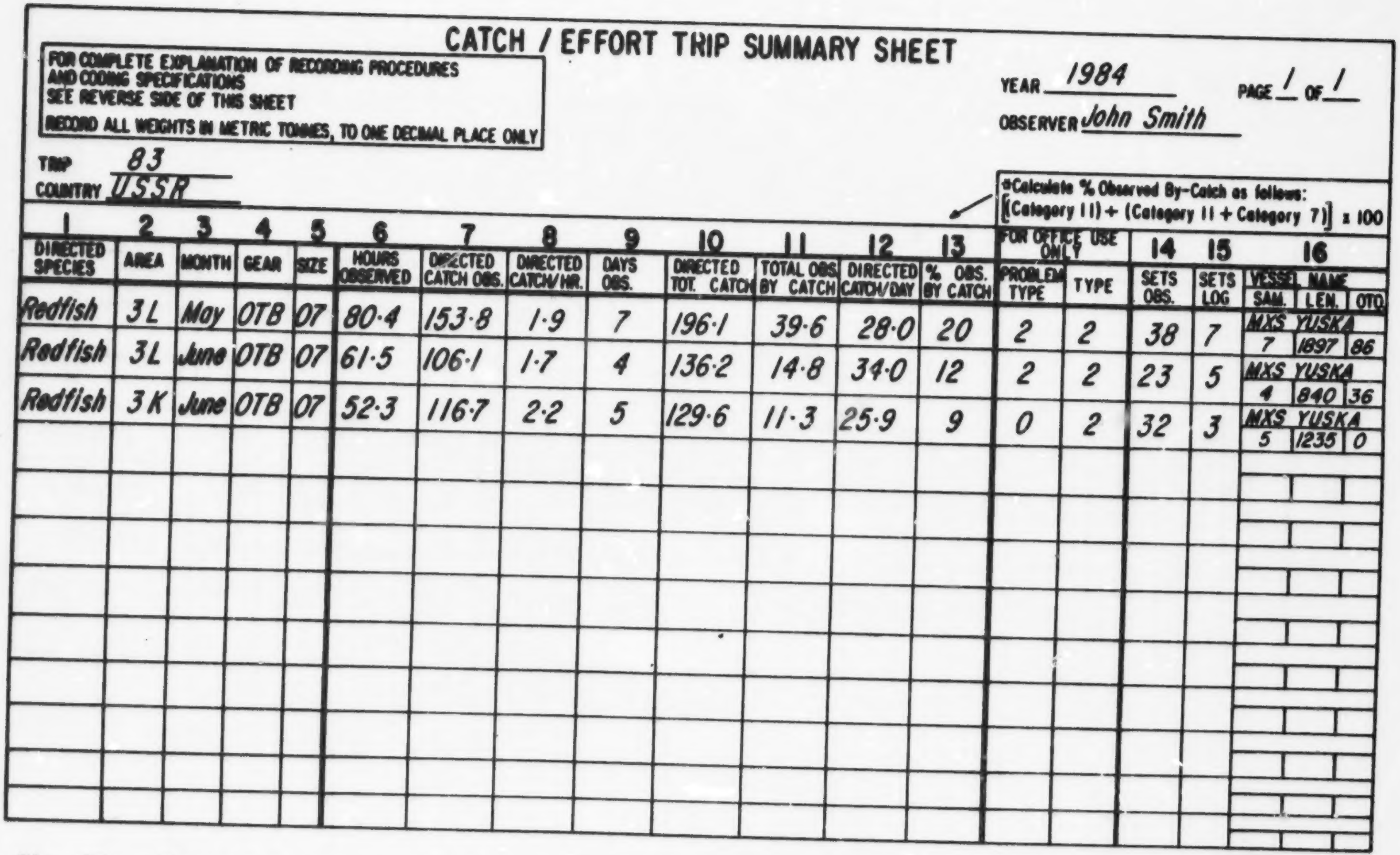


CATCH EFFORT WORK SHEET

SPECIES Redfish
TRIP 83
VESSEL TYPE OT-7
OBSERVER John Smith
COUNTRY USSR
MONTH Month
NAFO DIV 3L
YEAR 1984

SET #	DIRECTED CATCH WEIGHT (kg.)	HRS. FISHED	DIRECTED CATCH OBSERVED SETS ONLY	DAY	IN/OUT*	TOTAL BY-CATCH WEIGHT (kg.)	MAIN BY-CATCH NAME OF SPECIES
1	10406	3·4	10406	1		896	Cod
2	8214	4·2	8214	1	✓	1428	Cod
3	7943	6·2	7943	1		1379	Cod
4	11024	4·0		2		2414	Turbot
5	6917	3·5	6917	2		3674	Cod
6	8419	4·5	8419	2	✓	614	Cod
7	12711	4·5	12711	2		7128	Cod
8	3067	0·1		3		1064	Cod
9	14918	3·7	14918	3		2197	Turbot
10	3111	6·5	3111	3	✓	3666	Turbot
11	6214	3·2		4		1714	Turbot
12	8169	4·4	8169	4	✓	2119	Turbot
13	10247	4·2	10247	5	✓	3142	Turbot
14	12166	5·5	12166	5		1679	Cod
15	4339	2·4	4329	5		812	Cod
16	7418	5·2		5		964	Cod
17	6621	4·6	6621	5		1419	Turbot
18	9314	3·8	9314	6	✓	2122	Cod
19	4226	4·9	4226	6	✓	890	Cod
20	3714	4·2	3714	6		1460	Turbot
21	14618	5·1		7		1120	Turbot
22	13119	3·9	13119	7		1239	Cod
23	4832	2·4	4832	7	✓	4111	Cod
24	4418	1·6	4418	7	✓	894	Turbot
O-TOT		80·4	153804	7		39641	
A-TOT	196145	98·0		7		46917	

Fig. 26. Observer Program catch-effort work sheet.



CATCH / EFFORT TRIP SUMMARY SHEET

FOR COMPLETE EXPLANATION OF RECORDING PROCEDURES
AND CODING SPECIFICATIONS
SEE REVERSE SIDE OF THIS SHEET

RECORD ALL WEIGHTS IN METRIC TONNES, TO ONE DECIMAL PLACE ONLY

YEAR 1984

PAGE 1 OF 1

OBSERVER John Smith

TRIP 83

COUNTRY USSR

*Calculate % Observed By-Catch as follows:
[(Category 11) + (Category 11 + Category 7)] x 100

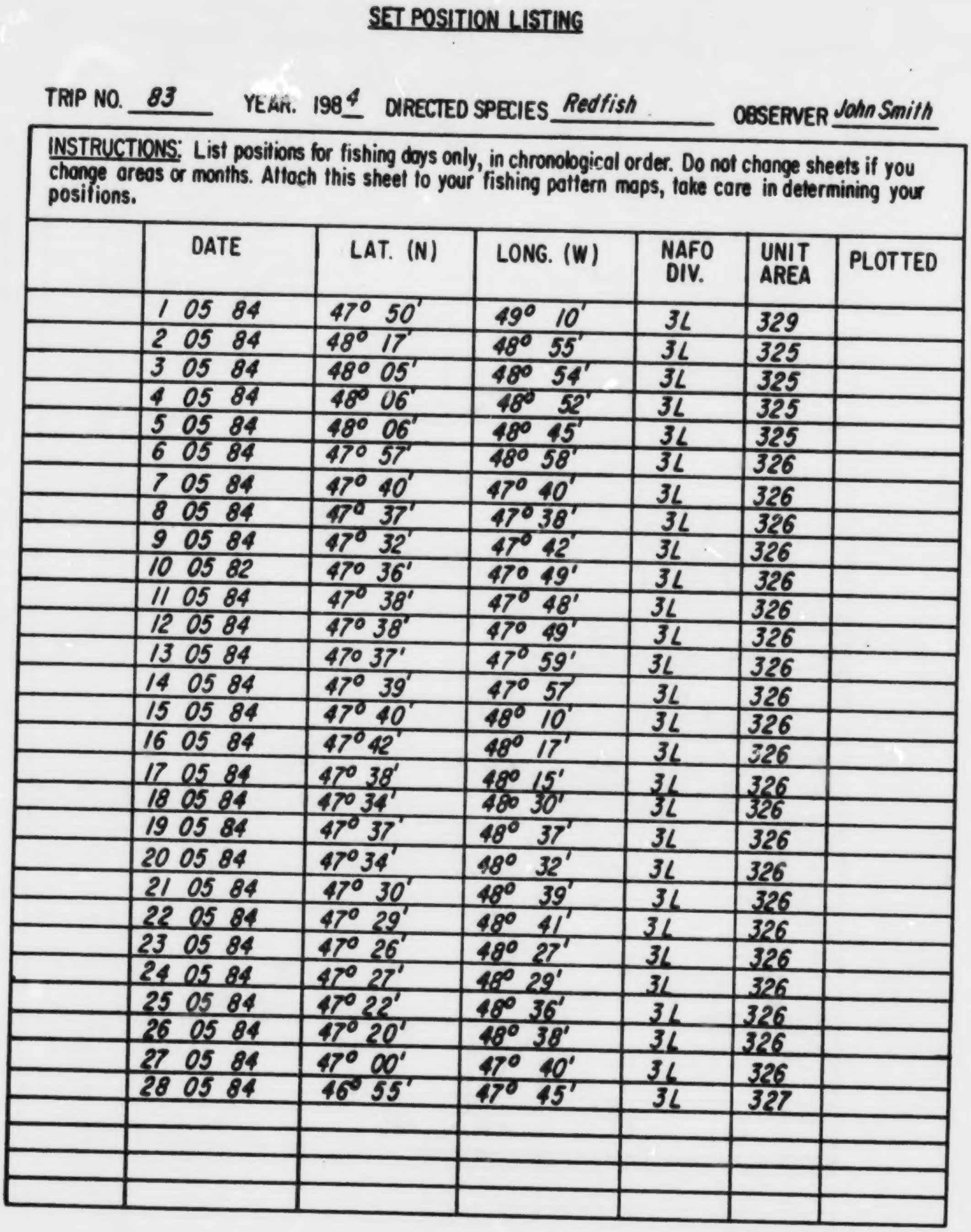
1	2	3	4	5	6	7	8	9	10	11	12	13	FOR OFFICE USE ONLY		14	15	16			
DIRECTED SPECIES	AREA	MONTH	GEAR	SIZE	HOURS OBSERVED	DIRECTED CATCH OBS.	DIRECTED CATCH/HR.	DAYS OBS.	DIRECTED TOT. CATCH	TOTAL OBS. BY CATCH	DIRECTED CATCH/DAY	% OBS. BY CATCH	PROBLEM TYPE	TYPE	SETS OBS.	SETS LOG	VESSEL NAME	SAM.	LEN.	OTO.
Redfish	3L	May	OTB	07	80·4	153·8	1·9	7	196·1	39·6	28·0	20	2	2	38	7	MXS YUSKA	7	1897	86
Redfish	3L	June	OTB	07	61·5	106·1	1·7	4	136·2	14·8	34·0	12	2	2	23	5	MXS YUSKA	4	840	36
Redfish	3K	June	OTB	07	52·3	116·7	2·2	5	129·6	11·3	25·9	9	0	2	32	3	MXS YUSKA	5	1235	0

Fig. 27a. Observer Program catch-effort summary sheet (front).

TRIP SUMMARY

SPECIES	MONTH	AREA	DAYS ON GROUND		DAYS FISHED		SETS OBS.		SETS LOG.		SAMPLES		LENGTHS		OTOLITHS	
			IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
Redfish	May	3L	7	2	5	2	31	7	6	1	7	0	1897	0	86	0
Redfish	June	3L	3	1	3	1	20	3	5	0	4	0	840	0	36	0
Redfish	June	3L	6	0	5	0	32	0	3	0	5	0	1235	0	0	0

Fig. 27b. Observer Program catch-effort summary sheet (back).



SET POSITION LISTING

TRIP NO. 83 YEAR. 1984 DIRECTED SPECIES Redfish OBSERVER John Smith

INSTRUCTIONS: List positions for fishing days only, in chronological order. Do not change sheets if you change areas or months. Attach this sheet to your fishing pattern maps, take care in determining your positions.

	DATE	LAT. (N)	LONG. (W)	NAFO DIV.	UNIT AREA	PLOTTED
	1 05 84	47° 50'	49° 10'	3L	329	
	2 05 84	48° 17'	48° 55'	3L	325	
	3 05 84	48° 05'	48° 54'	3L	325	
	4 05 84	48° 06'	48° 52'	3L	325	
	5 05 84	48° 06'	48° 45'	3L	325	
	6 05 84	47° 57'	48° 58'	3L	326	
	7 05 84	47° 40'	47° 40'	3L	326	
	8 05 84	47° 37'	47° 38'	3L	326	
	9 05 84	47° 32'	47° 42'	3L	326	
	10 05 82	47° 36'	47° 49'	3L	326	
	11 05 84	47° 38'	47° 48'	3L	326	
	12 05 84	47° 38'	47° 49'	3L	326	
	13 05 84	47° 37'	47° 59'	3L	326	
	14 05 84	47° 39'	47° 57'	3L	326	
	15 05 84	47° 40'	48° 10'	3L	326	
	16 05 84	47° 42'	48° 17'	3L	326	
	17 05 84	47° 38'	48° 15'	3L	326	
	18 05 84	47° 34'	48° 30'	3L	326	
	19 05 84	47° 37'	48° 37'	3L	326	
	20 05 84	47° 34'	48° 32'	3L	326	
	21 05 84	47° 30'	48° 39'	3L	326	
	22 05 84	47° 29'	48° 41'	3L	326	
	23 05 84	47° 26'	48° 27'	3L	326	
	24 05 84	47° 27'	48° 29'	3L	326	
	25 05 84	47° 22'	48° 36'	3L	326	
	26 05 84	47° 20'	48° 38'	3L	326	
	27 05 84	47° 00'	47° 40'	3L	326	
	28 05 84	46° 55'	47° 45'	3L	327	

Fig. 28. Observer Program set position listing form.

TRIP NO 83 YEAR 84 MONTH 05 DIR. SP. Redfish NAME J. S. COUNTRY USSR

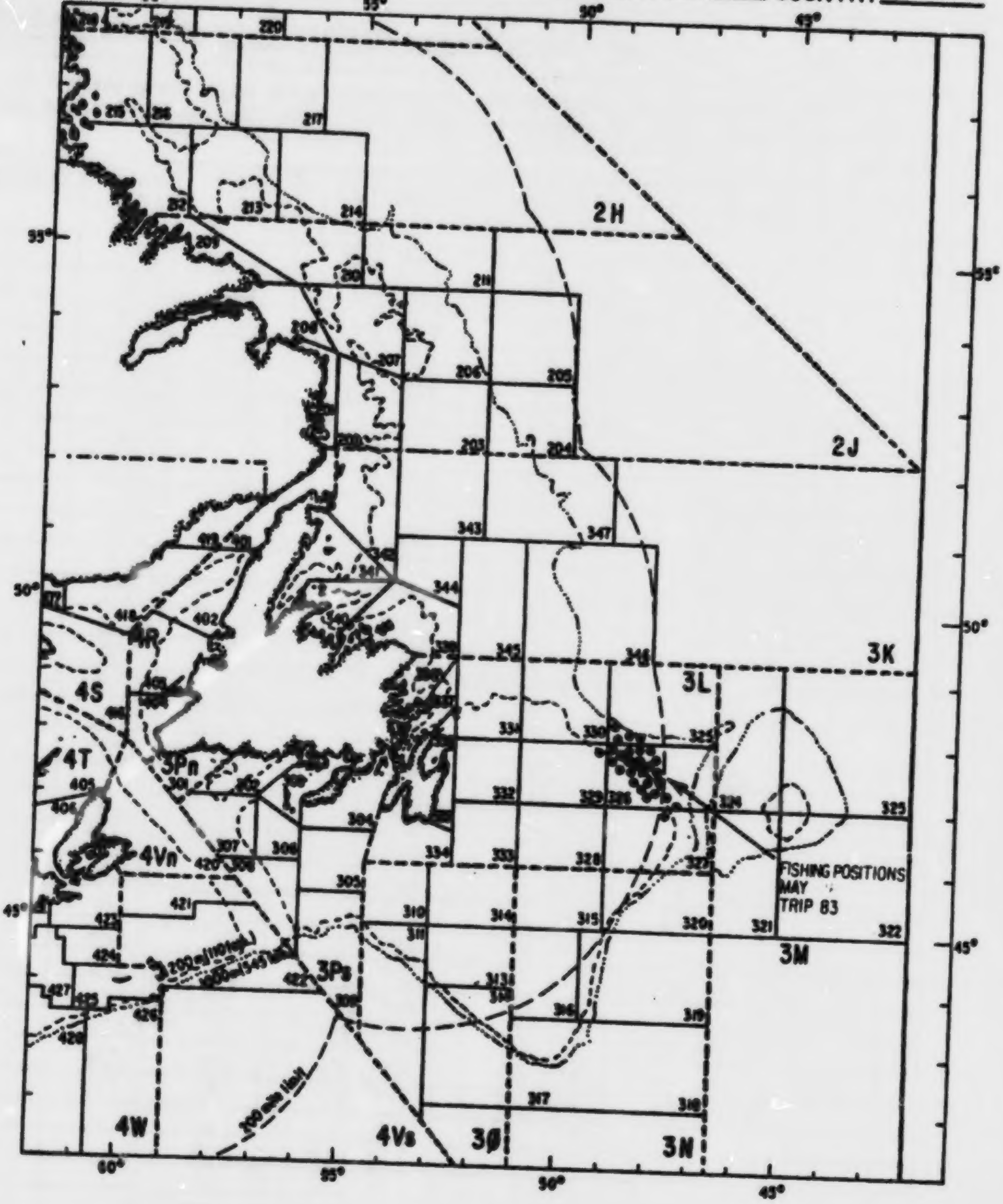
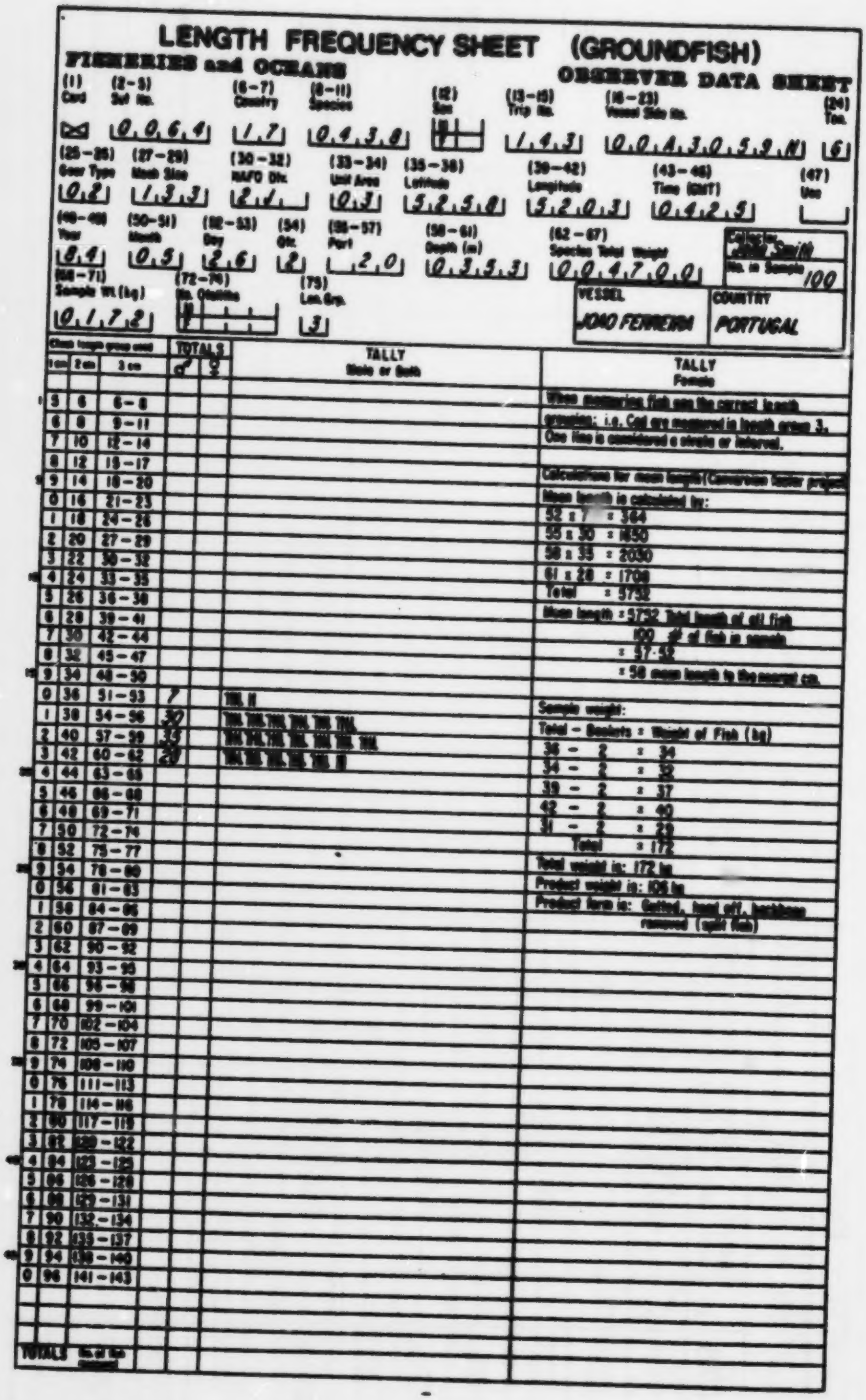


Fig. 29. Observer Program trip map.



LENGTH FREQUENCY SHEET (GROUNDFISH)

FISHERIES and OCEANS

OBSERVER DATA SHEET

(1) Card ☒
(2-5) Ref No. 0,0,6,4
(6-7) Country 1,7
(8-11) Species 0,4,3,8
(12) Sex
(13-15) Trip No. 1,4,3
(16-23) Vessel Side No. 0,0,A,3,0,5,9,N
(24) Ton. 6
(25-26) Gear Type 0,2
(27-29) Mesh Size 1,3,3
(30-32) NAFO Div. 2,J
(33-34) Unit Area 0,3
(35-38) Latitude 5,2,5,8
(39-42) Longitude 5,2,0,3
(43-46) Time (GMT) 0,4,2,5
(47) Use
(48-49) Year 8,4
(50-51) Month 0,5
(52-53) Day 2,6
(54) Qtr. 2
(55-57) Port 2,0
(58-61) Depth (m) 0,3,5,3
(62-67) Species Total Weight 0,0,4,7,0,0
Collector John Smith
No. in Sample 100
(68-71) Sample Wt. (kg) 0,1,7,2
(72-74) No. Otoliths
(75) Len. Grp. 3
VESSEL JOAO FERREIRA
COUNTRY PORTUGAL

Class length group used			TOTALS		TALLY Male or Both	TALLY Female
1 cm	2 cm	3 cm	♂	♀		
5	6	6-8				When measuring fish use the correct length
6	8	9-11				grouping: i.e. Cod are measured in length group 3.
7	10	12-14				One line is considered a stroke or interval.
8	12	15-17				
9	14	18-20				Calculations for mean length (Conversion factor project)
0	16	21-23				Mean length is calculated by:
1	18	24-26				52 x 7 = 364
2	20	27-29				55 x 30 = 1650
3	22	30-32				58 x 35 = 2030
4	24	33-35				61 x 28 = 1708
5	26	36-38				Total = 5752
6	28	39-41				Mean length = 5752 Total length of all fish
7	30	42-44				100 # of fish in sample
8	32	45-47				= 57.52
9	34	48-50				= 58 mean length to the nearest cm.
0	36	51-53	7		𝍸 ||	
1	38	54-56	30		𝍸 𝍸 𝍸 𝍸 𝍸 𝍸	Sample weight:
2	40	57-59	35		𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸	Total - Baskets = Weight of Fish (kg)
3	42	60-62	28		𝍸 𝍸 𝍸 𝍸 𝍸 |||	36 - 2 = 34
4	44	63-65				34 - 2 = 32
5	46	66-68				39 - 2 = 37
6	48	69-71				42 - 2 = 40
7	50	72-74				31 - 2 = 29
8	52	75-77				Total = 172
9	54	78-80				Total weight is: 172 kg
0	56	81-83				Product weight is: 105 kg
1	58	84-86				Product form is: Gutted, head off, backbone
2	60	87-89				removed (split fish)
3	62	90-92				
4	64	93-95				
5	66	96-98				
6	68	99-101				
7	70	102-104				
8	72	105-107				
9	74	108-110				
0	76	111-113				
1	78	114-116				
2	80	117-119				
3	82	120-122				
4	84	123-125				
5	86	126-128				
6	88	129-131				
7	90	132-134				
8	92	135-137				
9	94	138-140				
0	96	141-143				
TOTALS		No. of fish measured				

Fig. 30. Observer Program frequency sheet completed for a conversion factor experiment.

CONVERSION FACTOR DATA SUMMARY

VESSEL NAME JELYNYK

SPECIES NAME COD

Page 1 of 1

TRIP NO. 2,1,1 (1-3)

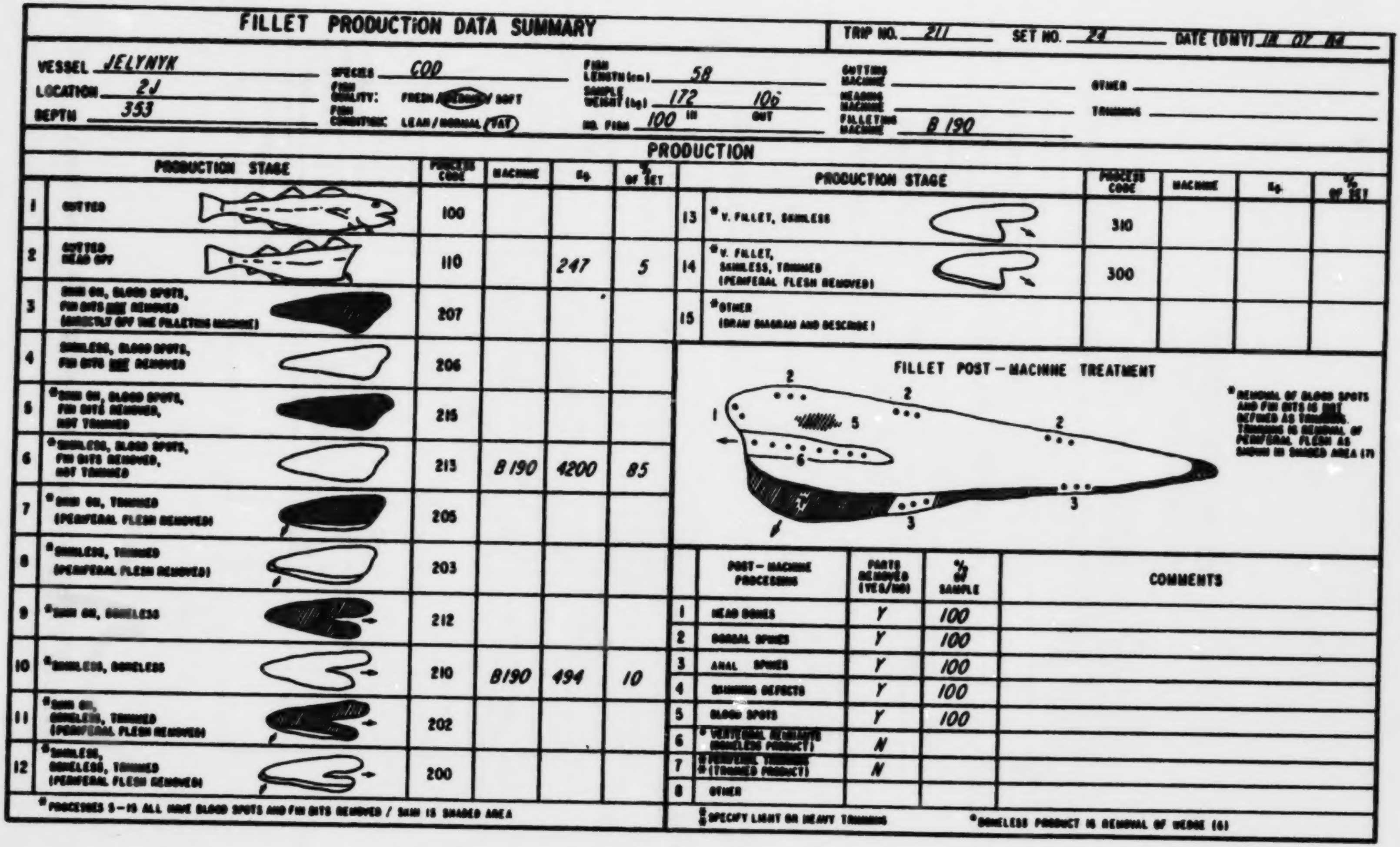
Side No. or CFV 8,M,4,7,8,3,0 (4-13)

SPECIES CODE 4,3,8 (14-17)

COUNTRY 1,6 (18-19)

3	3	6			3	4	4	5	3	3	4	2	3	1	
SAMPLE NUMBER	SET NUMBER	YY	DATE MM	DD	PROCESS METHOD	WHOLE WEIGHT	PRODUCT WEIGHT	CONVERSION FACTOR	NO. OF FISH	MEAN LENGTH	MACHINE TYPE	PROBLEM TYPE	NAFO DIV.	SAMPLE TYPE	COMMENTS
1	24	84	7	18	213	258	82	3·15	207	58	B 190		2J	1	
2	37	84	7	21	213	226	69	3·27	220	52	B 190		3K	1	

Fig. 31. Observer Program conversion factor data sheet.



FILLET PRODUCTION DATA SUMMARY

TRIP NO. 211 SET NO. 24 DATE (DMY) 18 07 84

VESSEL JELYNYK
LOCATION 2J
DEPTH 353

SPECIES COD
FISH QUALITY: FRESH / [illegible] / SOFT
FISH CONDITION: LEAN / NORMAL / [✓ FAT]

FISH LENGTH (cm) 58
SAMPLE WEIGHT (kg) 172 IN 106 OUT
NO. FISH 100

GUTTING MACHINE
HEADING MACHINE
FILLETING MACHINE B 190

OTHER
TRIMMING

PRODUCTION

	PRODUCTION STAGE	PROCESS CODE	MACHINE	Kg.	% OF SET
1	GUTTED	100			
2	GUTTED HEAD OFF	110		247	5
3	SKIN ON, BLOOD SPOTS, FIN BITS NOT REMOVED (DIRECTLY OFF THE FILLETING MACHINE)	207			
4	SKINLESS, BLOOD SPOTS, FIN BITS NOT REMOVED	206			
5	*SKIN ON, BLOOD SPOTS, FIN BITS REMOVED, NOT TRIMMED	215			
6	*SKINLESS, BLOOD SPOTS, FIN BITS REMOVED, NOT TRIMMED	213	B 190	4200	85
7	*SKIN ON, TRIMMED (PERIFERAL FLESH REMOVED)	205			
8	*SKINLESS, TRIMMED (PERIFERAL FLESH REMOVED)	203			
9	*SKIN ON, BONELESS	212			
10	*SKINLESS, BONELESS	210	B190	494	10
11	*SKIN ON, BONELESS, TRIMMED (PERIFERAL FLESH REMOVED)	202			
12	*SKINLESS, BONELESS, TRIMMED (PERIFERAL FLESH REMOVED)	200			

*PROCESSES 5—15 ALL HAVE BLOOD SPOTS AND FIN BITS REMOVED / SKIN IS SHADED AREA

	PRODUCTION STAGE	PROCESS CODE	MACHINE	Kg.	% OF SET
13	*V. FILLET, SKINLESS	310			
14	*V. FILLET, SKINLESS, TRIMMED (PERIFERAL FLESH REMOVED)	300			
15	*OTHER (DRAW DIAGRAM AND DESCRIBE)				

FILLET POST — MACHINE TREATMENT

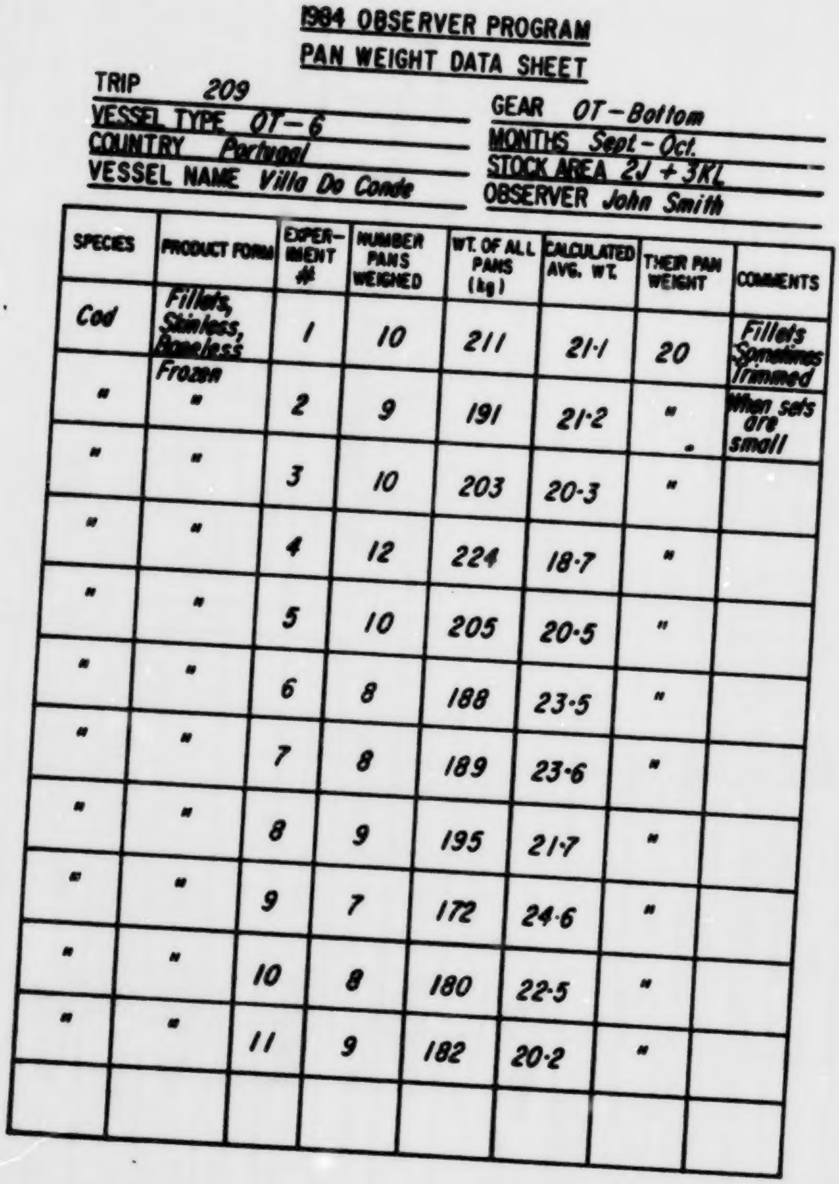
*REMOVAL OF BLOOD SPOTS AND FIN BITS IS NOT DEFINED AS TRIMMING. TRIMMING IS REMOVAL OF PERIFERAL FLESH AS SHOWN IN SHADED AREA (7)

	POST — MACHINE PROCESSING	PARTS REMOVED (YES/NO)	% OF SAMPLE	COMMENTS
1	HEAD BONES	Y	100	
2	DORSAL SPINES	Y	100	
3	ANAL SPINES	Y	100	
4	SKINNING DEFECTS	Y	100	
5	BLOOD SPOTS	Y	100	
6	*VERTEBRAL REMNANTS (BONELESS PRODUCT)	N		
7	‡PERIFERAL TRIMMING ‡(TRIMMED PRODUCT)	N		
8	OTHER			

‡SPECIFY LIGHT OR HEAVY TRIMMING

*BONELESS PRODUCT IS REMOVAL OF WEDGE (6)

Fig. 32. Observer Program fillet production data summary.



1984 OBSERVER PROGRAM

PAN WEIGHT DATA SHEET

TRIP 209

VESSEL TYPE OT-6

COUNTRY Portugal

VESSEL NAME Villa Do Conde

GEAR OT-Bottom

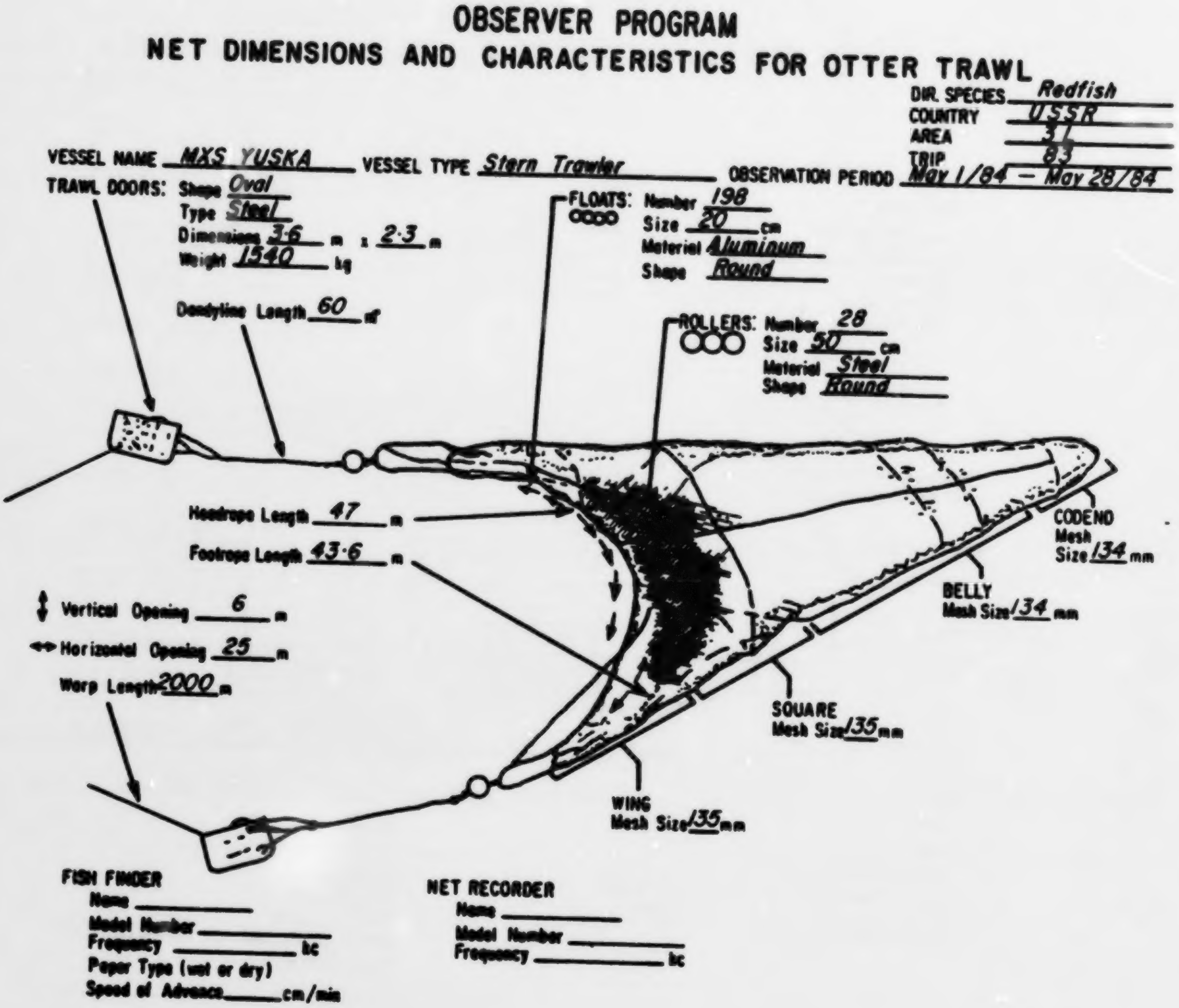
MONTHS Sept-Oct.

STOCK AREA 2J + 3KL

OBSERVER John Smith

SPECIES	PRODUCT FORM	EXPERIMENT #	NUMBER PANS WEIGHED	WT. OF ALL PANS (kg)	CALCULATED AVG. WT.	THEIR PAN WEIGHT	COMMENTS
Cod	Fillets, Skinless, Boneless Frozen	1	10	211	21·1	20	Fillets Sometimes Trimmed
"	"	2	9	191	21·2	"	When sets are small
"	"	3	10	203	20·3	"	
"	"	4	12	224	18·7	"	
"	"	5	10	205	20·5	"	
"	"	6	8	188	23·5	"	
"	"	7	8	189	23·6	"	
"	"	8	9	195	21·7	"	
"	"	9	7	172	24·6	"	
"	"	10	8	180	22·5	"	
"	"	11	9	182	20·2	"	

Fig. 33. Observer Program block weight data sheet.



OBSERVER PROGRAM
NET DIMENSIONS AND CHARACTERISTICS FOR OTTER TRAWL

DIR. SPECIES Redfish
COUNTRY USSR
AREA 31
TRIP 83

VESSEL NAME MXS YUSKA VESSEL TYPE Stern Trawler OBSERVATION PERIOD May 1/84 – May 28/84

TRAWL DOORS: Shape Oval
Type Steel
Dimensions 3·6 m x 2·3 m
Weight 1540 kg

Dandyline Length 60 m

FLOATS: Number 198
Size 20 cm
Material Aluminum
Shape Round

ROLLERS: Number 28
Size 50 cm
Material Steel
Shape Round

Headrope Length 47 m
Footrope Length 43·6 m

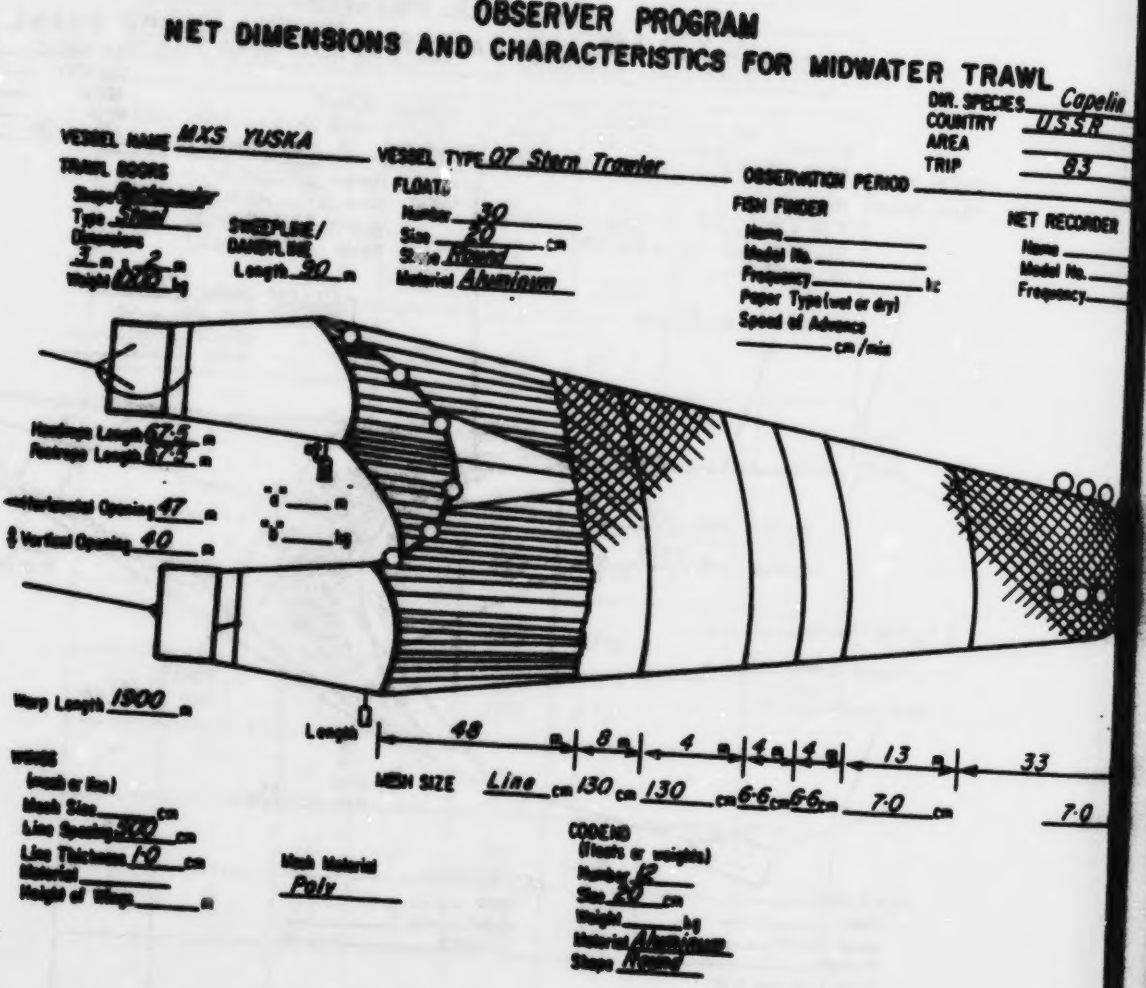
↕ Vertical Opening 6 m
↔ Horizontal Opening 25 m
Warp Length 2000 m

CODEND Mesh Size 134 mm
BELLY Mesh Size 134 mm
SQUARE Mesh Size 135 mm
WING Mesh Size 135 mm

FISH FINDER
Name ______
Model Number ______
Frequency ______ kc
Paper Type (wet or dry)
Speed of Advance ______ cm/min

NET RECORDER
Name ______
Model Number ______
Frequency ______ kc

Fig. 34. Diagram of bottom trawl with required data entries.



OBSERVER PROGRAM
NET DIMENSIONS AND CHARACTERISTICS FOR MIDWATER TRAWL

DIR. SPECIES Capelin
COUNTRY USSR
AREA
TRIP 83

VESSEL NAME MXS YUSKA
VESSEL TYPE 07 Stern Trawler
OBSERVATION PERIOD

TRAWL DOORS
Shape Rectangular
Type Steel
Dimensions
3 m x 2 m
Weight 1000 kg

SWEEPLINE/
DANDYLINE
Length 90 m

FLOATS
Number 30
Size 20 cm
Shape Round
Material Aluminium

FISH FINDER
Name
Model No.
Frequency kc
Paper Type (wet or dry)
Speed of Advance
cm/min

NET RECORDER
Name
Model No.
Frequency

Headrope Length 67.5 m
Footrope Length 67.5 m
Horizontal Opening 47 m
Vertical Opening 40 m
"a" m
"b" kg

Warp Length 1900 m

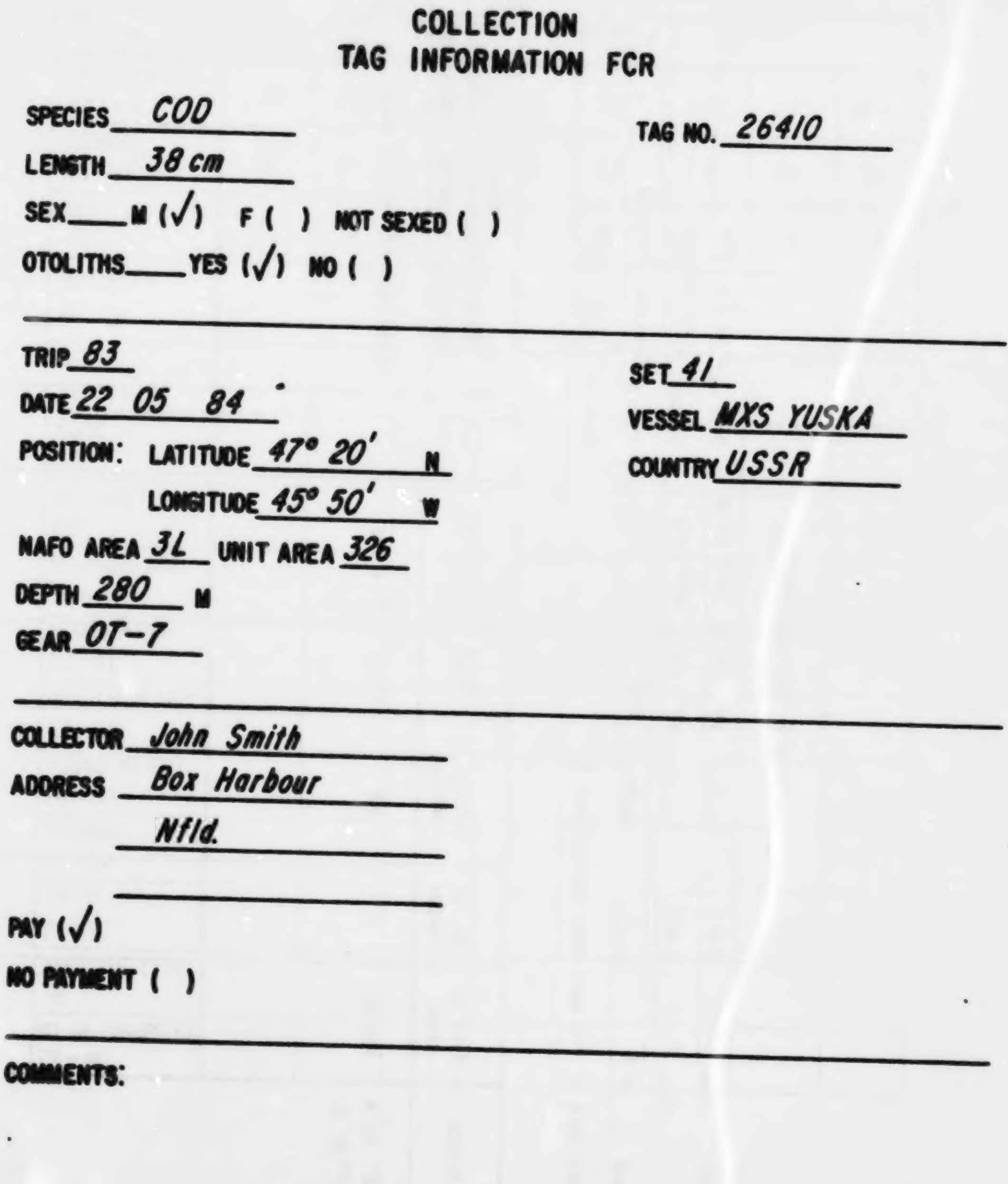
Length 48 m | 8 m | 4 m | 4 m | 4 m | 13 m | 33
MESH SIZE Line cm 130 cm 130 cm 6.6 cm 6.6 cm 7.0 cm 7.0

WINGS
(mesh or line)
Mesh Size cm
Line Spacing 300 cm
Line Thickness 1.0 cm
Material
Height of Wings m

Mesh Material
Poly

CODEND
(floats or weights)
Number 12
Size 20 cm
Weight kg
Material Aluminium
Shape Round

Fig. 35. Diagram of midwater trawl with required data entries.



COLLECTION
TAG INFORMATION FCR

SPECIES *COD*
TAG NO. *26410*
LENGTH *38 cm*
SEX M (✓) F ( ) NOT SEXED ( )
OTOLITHS YES (✓) NO ( )

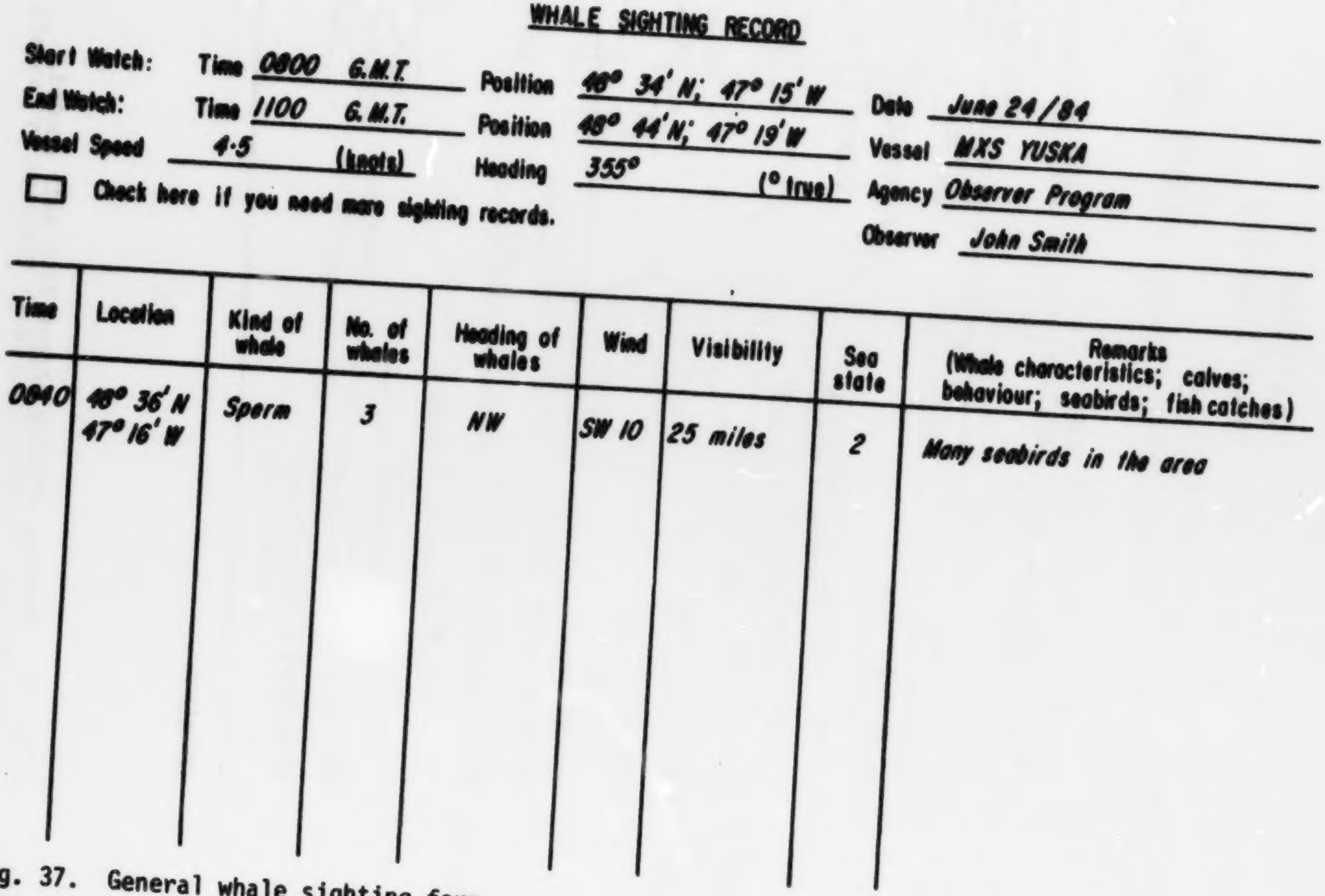
TRIP *83*
SET *41*
DATE *22 05 84*
VESSEL *MXS YUSKA*
POSITION: LATITUDE *47° 20'* N
COUNTRY *USSR*
LONGITUDE *45° 50'* W
NAFO AREA *3L* UNIT AREA *326*
DEPTH *280* M
GEAR *OT-7*

COLLECTOR *John Smith*
ADDRESS *Box Harbour*
Nfld.

PAY (✓)
NO PAYMENT ( )

COMMENTS:

Fig. 36. Observer Program tagged fish data record.



WHALE SIGHTING RECORD

Start Watch: Time 0800 G.M.T. Position 48° 34' N; 47° 15' W Date June 24/84

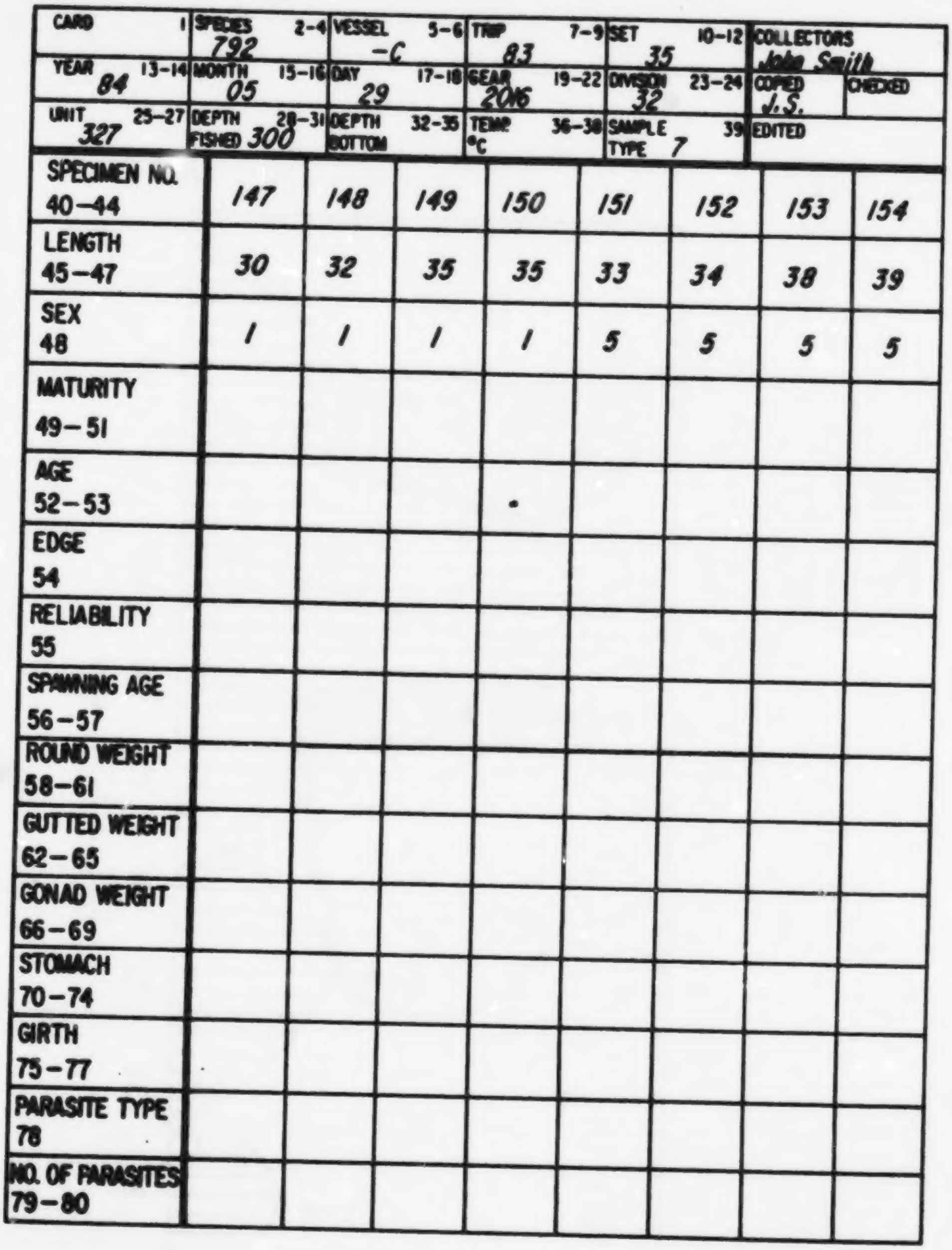
End Watch: Time 1100 G.M.T. Position 48° 44' N; 47° 19' W Vessel MXS YUSKA

Vessel Speed 4·5 (knots) Heading 355° (° true) Agency Observer Program

☐ Check here if you need more sighting records. Observer John Smith

Time	Location	Kind of whale	No. of whales	Heading of whales	Wind	Visibility	Sea state	Remarks (Whale characteristics; calves; behaviour; seabirds; fish catches)
0840	48° 36' N 47° 16' W	Sperm	3	NW	SW 10	25 miles	2	Many seabirds in the area

Fig. 37. General whale sighting form.



CARD 1	SPECIES 2-4 792	VESSEL 5-6 -C	TRIP 7-9 83	SET 10-12 35	COLLECTORS John Smith	
YEAR 13-14 84	MONTH 15-16 05	DAY 17-18 29	GEAR 19-22 2016	DIVISION 23-24 32	COPIED J.S.	CHECKED
UNIT 25-27 327	DEPTH FISHED 28-31 300	DEPTH BOTTOM 32-35	TEMP. °C 36-38	SAMPLE TYPE 39 7	EDITED	

SPECIMEN NO. 40-44	147	148	149	150	151	152	153	154
LENGTH 45-47	30	32	35	35	33	34	38	39
SEX 48	1	1	1	1	5	5	5	5
MATURITY 49-51								
AGE 52-53								
EDGE 54								
RELIABILITY 55								
SPAWNING AGE 56-57								
ROUND WEIGHT 58-61								
GUTTED WEIGHT 62-65								
GONAD WEIGHT 66-69								
STOMACH 70-74								
GIRTH 75-77								
PARASITE TYPE 78								
NO. OF PARASITES 79-80								

Fig. 38. Age and Growth sheet.

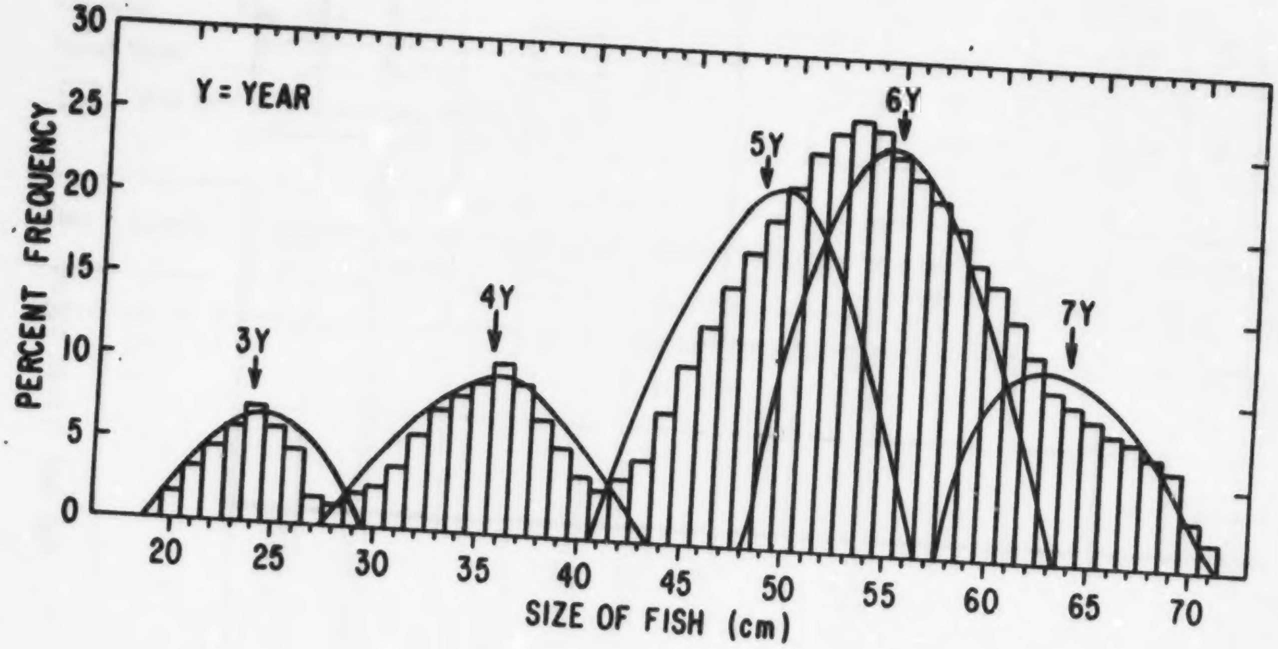


Fig. 39. Fish size distribution of a theoretical stock.

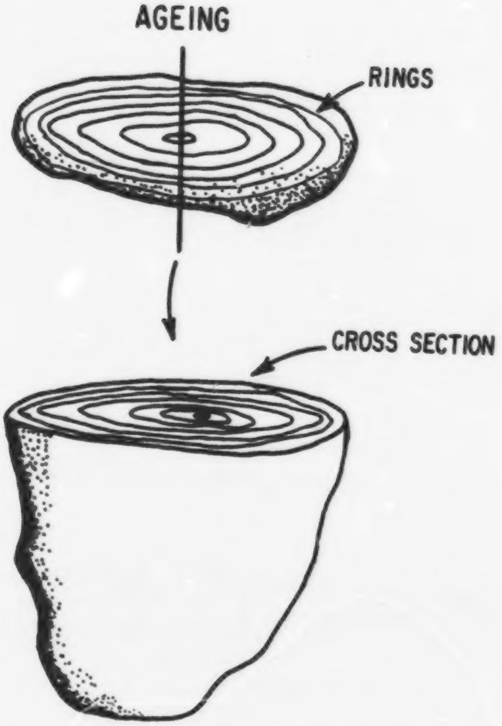


Fig. 40. Illustration of how the otolith is used for ageing.

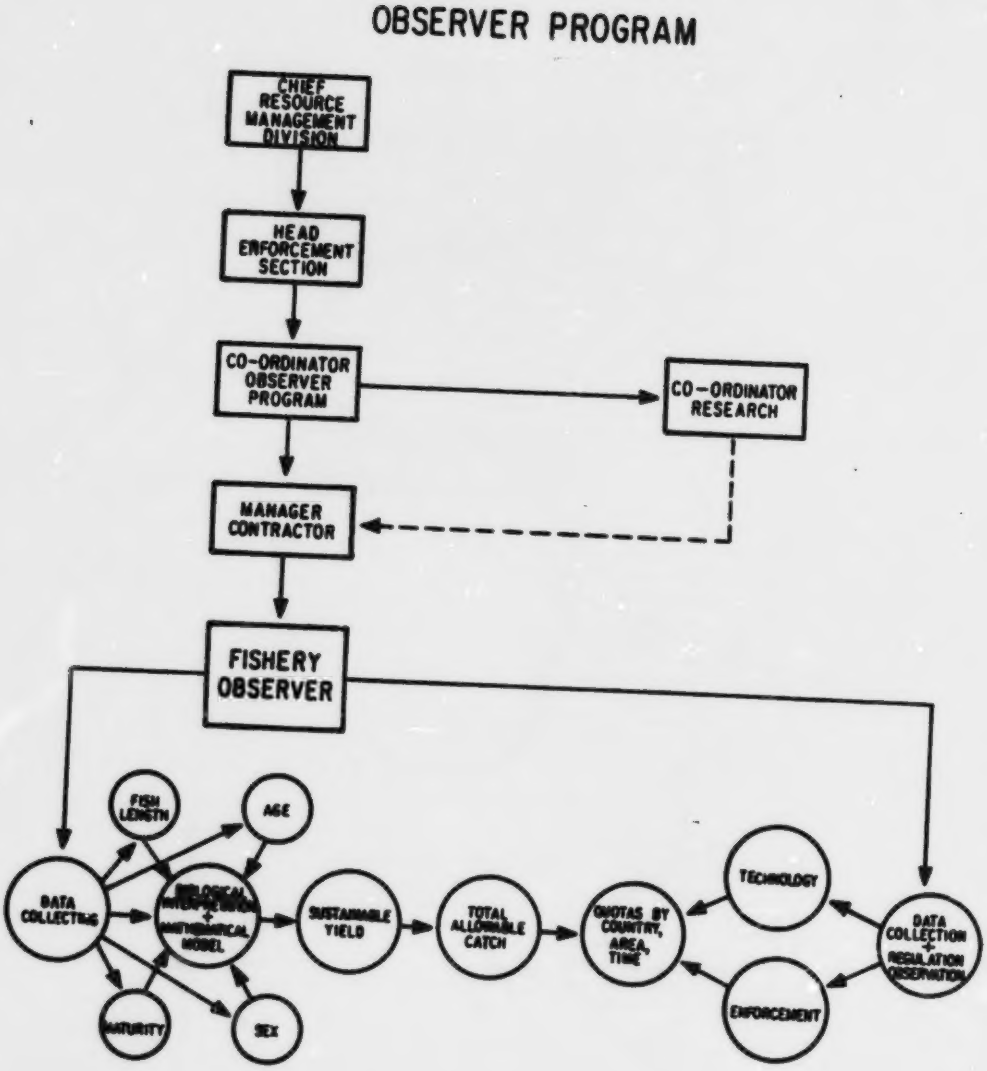


Fig. 41. Fisheries Observer flowchart illustrating program structure and functions.

APPENDIX 1: STOCK AREAS FOR COMMERCIAL SPECIES

Each species is managed by stock (separate population entity) although you are generally asked to collect data by NAFO division. These data are then combined by the computer into stock areas. The following are lists of stock areas for the various species.

COD

2GH
2J + 3KL
3M
3NO
3PS
4TVN
4VN
4VSW
4RS + 3PN

REDFISH

2 + 3K
3M
3LN
3O
3P
4RST
4VWX

AMERICAN PLAICE

2 + 3K
3M
3LNO
3PS
4T

YELLOWTAIL

3LNO

WITCH FLOUNDER

2J + 3KL
3NO
3PS
4RS

HADDOCK

4VW
4X

CAPELIN

2 + 3K
3LNO
4RST

POLLOCK

4VWX + 5

TURBOT

2 + 3KL

RN GRENADIER

2 + 3

SILVER HAKE

4VWX

ARGENTINE

4VWX

SQUID

3 + 4

APPENDIX 2: OBSERVER TRIP REPORT

Observer's Name:

Trip #:

SECTION 1

Assigned Vessel

Vessel Name:
Side No:
License/CFV No:
Vessel Type:

Flag State:
Home Port:
No. Crew (regular):
No. Crew (others):

SECTION 2

Trip Record

	Vessel Name	Location	Date	Time (GMT)
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				

Briefed by: Date:

Debriefed by: Date:

APPENDIX 2: (Cont'd.)

SECTION 3

Living & Working Conditions

(a) Cabin/ Single: ________ Shared: ________ No. of people: ________

(b) Hygenic Facilities (comment) ________________________________

____

Good: ________ Adequate: ________ Fair: ________ Poor: ________

(c) Sampling Area (location) ________________________________

____

Good: ________ Adequate: ________ Fair: ________ Poor: ________

(d) Crew Co-operation ________________________________

Good: ________ Adequate: ________ Fair: ________ Poor: ________

General Comments

APPENDIX 2: (Cont'd.)

SECTION 4

Inspections/Boardings

(a) Date: ______________________

Patrol Vessel: ______________________

Inspector's Name: ______________________

Reason for Inspection: Routine __________ Requested __________

If Requested Give Reason & Response Time:

____

____

Results of Inspection:

____

____

Comments:

____

____

(b) Date: ______________________

Patrol Vessel: ______________________

Inspector's Name: ______________________

Reason for Inspection: Routine __________ Requested __________

If Requested Give Reason & Response Time:

____

____

Results of Inspection:

____

____

Comments:

____

____

APPENDIX 2: (Cont'd.)

SECTION 5

FISHING STRATEGY

- Describe the captain's overall fishing strategy and how it is influenced by the following factors:
- Depth Ranges
- Bottom Features
- Water Temperatures
- Currents
- Weather Conditions
- Other Vessels
- Company Imposed Trip Limits (if applicable)
- By-Catch Levels (if applicable)

Note: In the case of high by-catch levels, detail the captains efforts (if any) to alleviate the problem.

APPENDIX 2: (Cont'd.)

SECTION 6

FISHING GEAR

Relate any significant points of interest concerning the fishing gear used onboard. Pay particular attention to the following:

- Type of gear, material and mesh size (if applicable)
- Modifications made to gear during the trip (i.e. "windows" cut in forward part of codend)
- Noticeable effect on catch due to modifications (i.e. size, by-catch, discards, etc.)
- Description of gear attachments, strengthening ropes, topside chafer, etc. (A diagram would be useful).
- In the case of longlines or gillnets, you should comment on the amount of gear used (i.e. Number of lines and hooks or number of nets and length) and the frequency with which it was hauled.

APPENDIX 2: (Cont'd.)

SECTION 7

FISHING OPERATION

In this section, describe the procedure used on board the vessel when:

i) shooting the trawl
ii) towing
iii) hauling back the trawl, and
iv) emptying the trawl

Your presentation should be such that this chronological sequence of events can be understood by individuals not directly familiar with a trawlers fishing operation. Parameters such as speed, towing time, course, warp length/drag and tension and equipment like winches, blocks, vertical and horizontal pulley systems, otter boards, etc.--should be mentioned in this section. In addition, the usage of electronic fish-finding equipment such as sounders, net recorders and sonar should be described as it relates to the overall fishing operation.

APPENDIX 2: (Cont'd.)

SECTION 8

CATCH AND EFFORT INFORMATION

A. Complete the attached catch and effort talley sheet(s). Use one line for each set entering your own round weight estimates of catch. At the end of each fishing day (24:00 GMT if on a foreign vessel or midnight if on a domestic vessel) total the days catch by quota area(s) using one line for each area.

Note: See the list of quota areas included with the radio message format instructions.

B. Use attached summary sheet(s) to enter your weekly (Wednesday to Tuesday, inclusive) catch totals by quota area. At the end of a trip, add these weekly totals together, by quota area, to obtain the trip totals. Note: On this sheet record only the directed catch and significant amounts of regulated species taken as bycatch.

C. i) Describe in detail how the captain arrives at the round weight estimates of catch entered in the fishing log (directed species, bycatch, and discards). Comment on the effort the captain devotes to obtaining accuracy in this procedure.

APPENDIX 2: (Cont'd.)

8C. ii) In your opinion, is the captain's procedure for estimating round weight the best that could be practically employed on this vessel? If no, can you suggest a more accurate method?

iii) Significant differences between your estimates and those recorded in the fishing log should be described in detail, identifying the factors that could possibly contribute to these discrepancies.

iv) Comment on any significant differences in the captain's estimates of catch per haul (directed species, by-catch and discards) between observed and unobserved sets.

APPENDIX 2: (Cont'd.)

SECTION 9

PROCESSING AND PRODUCTION

A. Pre-Processing

In this section, a labelled flowchart or flowcharts and/or a detailed description of the handling of the catch from the moment the trawl is emptied is required. This should include any information needed for someone who has not been on your ship to understand:

i) How and under what conditions fish is stored while awaiting processing.

ii) How fish is sorted by species and size in preparation for processing. Identify the criteria used by the crew to determine what fish are to be discarded (e.g. catch size, company policy, amount of by-catch, time awaiting processing, etc.).

Note: Do not describe in detail here each individual process. Merely, note the process, such as "small cod go to machine filleting line, large cod go to hand processing section, by-catch of wolffish go to meal plant, etc.".

APPENDIX 2: (Cont'd.)

9B. Production Machinery Summary

Complete the following table, identifying each machine type in use on board, including freezers and meal plant. The comments section should include:

i) The Theoretical capacity of each machine to process fish (e.g. If available, according to manufacturer's handbook. State source).

ii) The actual machine capacity determined by interview and/or observation (state source).

iii) Reasons why machinery does not operate at theoretical levels.

Name/Model	Function	# Units	Age	Comments

APPENDIX 2: (Cont'd.)

9C. Diagram of Factory Deck

In this section, sketch a layout of the factory deck including, but not limited to:

- fish holding areas
- processing machines
- work areas where hand processing is performed
- freezers

APPENDIX 2: (Cont'd.)

9D. Product Types and Process Descriptions

In this section, identify each product type being manufactured on board, giving a detailed account of all the processes involved, including packaging (describe package I.D.) and freezing. Make sure that a detailed diagram of each final product is included and labeled, showing where cuts were made, how much trimming occurred, the amount of bone removed, etc. (Refer to the conversion factor memo for a set of product descriptions and diagrams.) Accompanying these product diagrams estimate what round weight percentage of each species was processed into each product form (e.g. 85% of round cod was processed into skinless, boneless, trimmed fillets - remaining 15% was headed and gutted, etc.).

Include additional diagrams and flowcharts where necessary.

Note: In the case of salt fish production, be sure to determine the amount of salt used per metric ton of split fish.

APPENDIX 2: (Cont'd.)

9E. System Capacity- Limiting Factors

In this section should be included information, derived from interview and/or obervation, pertaining to limiting factors or "Bottlenecks" in the production process (e.g. a restricted number of crew members available for a labor-intensive processing step such as trimming or packing fillets).

APPENDIX 2: (Cont'd.)

9F. Quality of Product(s)

Use this section to describe any factors that might adversely affect the quality of the product(s) produced on board (e.g. delay in processing, storage conditions while awaiting processing, etc.).

APPENDIX 2: (Cont'd.)

9G. Production Operation Strategy

Describe any production strategy, evident from observation or determined by interview, which might control or direct the processing operation. In doing so, it could be of use to seek answers to the following questions:

- What markets are the products aimed at?
- Would the company management prefer the vessels to take large catches and do minimal processing or to take smaller catches and do more labour-intensive processing?
- With respect to the previous question, what would the optimum catch rate be?
- What specific production methods were used to optimize profits?
- Were production methods streamlined or changed for any reason during the course of the trip?
- How do the relative amounts of each product produced reflect the influence of the factors listed in the questions posed above?

APPENDIX 2: (Cont'd.)

9H. Production Figures

On the basis of the ships production log and/or interview determine how much of each product form, including meal, was laid down during the trip. Enter these production totals in the table below, specifying their source. If these fiqures were obtained from the log use the comments section to explain how they were derived and kept before entry into the log.

Species	Product Description and code	Weight (kg)	Source	Comments

APPENDIX 2: (Cont'd.)

9I. Conversion Factor Data - Ship's Factors

By species and process, list in the table below all the conversion factors you can obtain that are used on board. Use the comments section to state how these are arrived at (e.g. captain decides or owner decides).

Species	Process	C. F.	Comments

APPENDIX 2: (Cont'd.)

9J. Conversion Factor Data - Yours

You will have filled out your conversion factor length frequency sheets and conversion factor summary sheets before completing this section.

How would you account for variance, if any, within conversion factors obtained from samples, of a given species and size range, that have undergone identical processing. Provide this information separately by species and process.

APPENDIX 2: (Cont'd.)

SECTION 10:

OTHER

Refer to briefing instructions:

APPENDIX 2: (Cont'd.)

SECTION 11:

DISCARDING OF REGULATED SPECIES (DOMESTIC VESSELS ONLY)

If there was any discarding of regulated species on board this vessel, describe in detail the circumstances involved. In doing so, identify the criteria used by the crew to determine what fish are to be discarded (e.g. catch size, company policy, amount of by-catch, time awaiting processing, etc.).

APPENDIX 2: (Cont'd.)

SECTION 12:

IRREGULARITIES AND SUSPECTED BREACHES OF REGULATIONS

Describe in detail any irregularities or suspected breaches of Canadian Fisheries Legislation observed during the trip. Your description must include all pertinent details, such as dates, times, locations, specific amounts of catch involved, etc. Techniques followed to substantiate your information should also be included. Refer to the appropriate section above if necessary.

Note: In the event of possible court action all details pertaining to fishing operations, specifically those relating to irregularities, should be documented in your diary.

APPENDIX 2: (Cont'd.)

SECTION 13:

RECOMENDATIONS

If there was a problem situation on board this vessel, use this section to outline any recommendations you might have that would enable observers to avoid its reoccurrence on subsequent trips.

APPENDIX 2: (Cont'd.)

SECTION 14

GENERAL COMMENTS

APPENDIX 3: TABLE 1. SET AND CATCH SHEET SPECIFICATIONS.

Field	Columns	Codes and Notes
Year	1-2(2)	1984 = 84
Country	3-4(2)	Determine flag state of the vessel and the appropriate code. Bulgaria = 1 Canada (M&Q) = 2 Canada (Nfld.) = 3 Cuba = 4 Denmark (Faroe) = 5 Denmark (Greenland) = 6 Denmark (Mainland) = 7 France (Metro) = 8 France (St. P&M) = 9 FRG =10 GDR =11 Iceland =12 Italy =13 Japan =14 Norway =15 Poland =16 Portugal =17 Romania =18 Spain =19 USSR =20 UK =21 USA =22 Israel =23 Ireland =24
Side Number	5-14(10)	Code in actual side number of vessel. Note: (1) Side number is right justified. (2) Distinguish between letters and numbers in the side number by observing the following guide: Letter O=Ø Letter I=I Letter Z=Ƶ Zero =0 Letter L=L Number 2=2 Number 1=1 Number 7=7 Example: FØI742
Vessel Horse Power	15-18(4)	Code in actual vessel horse power.

Table 1. (Cont'd.)

Field	Columns	Codes and Notes
Trip Number	19-22(4)	Code actual trip number assigned for trip.
Set Number	23-25(3)	Start at one (1) each trip and number sets consecutively whether sets are observed or logged.
Gear Size and Type	26-29(4)	26-27 Gear size is based on gross tonnage of vessel and is coded as follows:

Tonnage	Code
0-24.9	01
25-49.9	02
50-149.9	03
150-499.9	04
500-999.9	05
1000-1999.9	06
2000+	07

28-29 Signify gear type and code as follows:

Gear Type	Code
Otter trawl (stern)	01
Otter trawl (side)	02
Danish seine	03
Cod trap	04
Gillnet (fixed)	05
Longline (line trawl) LL	07
Handline (jigger)	08
Scottish (seine)	09
Purse seine	10
Miscellaneous	11
Unspecified	12
Rake and tong	13
Bar seine	14
Gillnet (drift)	15
Midwater trawl	16
Shrimp trawl (unspecified)	17
Pair trawl	18
Long line and gillnet	20
Off bottom chain	21
Automatic jigger	22

Table 1. (Cont'd.)

Field	Columns	Codes and Notes	
		Scallop dredge	23
		Off Bottom Box Trawl (Japan)	24
			25
			26
			27
			28
			29
		Sputnik 1200 Danish	30
		Sputnik 1400 Danish	31
		Sputnik 1600 Danish	32
		Sputnik 1800 Danish	33
		Sputnik 2000 Danish	34
		Sputnik 1200 Norwegian	35
		Sputnik 1400 Norwegian	36
		Sputnik 1600 Norwegian	37
		Sputnik 1800 Norwegian	38
		Sputnik 2000 Norwegian	39
		Sputnik (unspecified)	40
		Kalut (Danish)	41
		Kalut Norwegian	42
		Iver Christensen (Shrimp)	43
		Kalut (unspecified)	44
		Columbia (unspecified)	45
Codend Mesh Size	30-32(3)	Code in actual mesh size of codend in mm.	
Body Mesh Size	33-35(3)	Code in actual mesh size of body in mm if gear is an otter trawl.	
		If gear is gillnet, code in actual mesh size of gillnets in mm.	
Roller Size	36-38(3)	Code in actual diameter of rollers in cm.	
Chaffing Gear	39(1)	Chaffing gear types will be coded as follows (topside chafer):	
		Type	Code
		No Topside Chafer	0
		Polish	1
		ICNAF	2
		Modified ICNAF	3

Table 1. (Cont'd.)

Field	Columns	Codes and Notes
		Multiflap 4 Other 5
Number of Gillnets Hauled	40-42(3)	Code in actual number of gillnets hauled on that day.
Number of Hooks	(43-46)4	Determine number of hooks hauled for that set, then divide this number by ten (10), i.e. 29,000 hooks hauled is recorded as 29,000 ÷ 10 = 2900. 2 9 0 0
Net Damage	47(1)	Code as follows: No damage 1 Damage: no fish loss 2 Damage: fish loss 3
In/Out 200 Miles	48(1)	In=1 Out=2
Day	49-50(2)	Day (actual calendar day on which set commenced) 1-31
Month	51-52(2)	Jan = 1 Feb = 2 Mar = 3 Apr = 4 May = 5 June = 6 July = 7 Aug = 8 Sept = 9 Oct = 10 Nov = 11 Dec = 12

Table 1. (Cont'd.)

Field	Columns	Codes and Notes
NAFO Division	53-54(2)	Code as follows:
		Ungava Bay = 6
		Baffin Island-Subarea Zero = 9
		Division 1A = 11
		Division 1B = 12
		Division 1C = 13
		Division 1D = 14
		Division 1E = 15
		Division 1F = 16
		Division 2G = 21
		Division 2H = 22
		Division 2J = 23
		Division 3K = 31
		Division 3L = 32
		Division 3M = 33
		Division 3N = 34
		Division 30 = 35
		Subdivision 3Pn = 36
		Subdivision 3Ps = 37
		Division 4R = 41
		Division 4S = 42
		Division 4T = 43
		Subdivision 4Vn = 44
		Subdivision 4Vs = 45
		Division 4W = 46
		Division 4X = 47
Unit Area	55-57(3)	Code in actual unit area, e.g. 301, 211, etc.
Vessel Tow Speed	58-59(2)	Record the average vessel tow speed in knots to the nearest 10th of a knot. The space to the right is a decimal place. Observe the following examples: Tow speed - Coded as 4.2 knots - 4 2 3 knots - 3 0

Table 1. (Cont'd.)

Field	Columns	Codes and Notes
Start Latitude	60-63(4)	Code in position in degrees and minutes. Note: Start of set is when gear effectively starts fishing.
Start Longitude	64-67(4)	Code in position in degrees and minutes. Note: Start of set is when gear effectively starts fishing.
Average Depth	68-71(4)	Direct code to the nearest meter, the average depth of the tow.
Start Time GMT	72-75(4)	Code in actual start time in GMT using the 24 hr scale.
Duration	76-79(4)	Actual duration of tow from start to finish. Note: Last place to the right is a decimal place and indicates 10th of an hour. For example, a duration of 3 hr and 45 min is 3.75 hr rounded off to the nearest tenth is 3.8 and is coded 3 8 A duration of 3 hr is 3.0 which is coded as 3 0
Data Source	80(1)	Observed = 1 Logged = 2
Directed Species	81-84(4)	Code in species sought for this set Note: See species code list for codes.
Number of Species	85-86(2)	Direct code number of species caught in this set.

Table 1. (Cont'd.)

Field	Columns	Codes and Notes
Quota (Country)	87-88(2)	Determine which countries' quota is to be fished and fill in the appropriate country code corresponding to quota origin. Refer to the country codes listed under the category "Country" columns 3-4.
Trip Type	89-90(2)	Select the appropriate trip type from the list below and enter the correct code. Domestic vessel-Domestic quota 1 Foreign vessel-Foreign quota 2 Resource short plant program 3 Charter 4 Over the side sales 5 Inshore/Midshore 6 Research 7 8 9 10
Record Type Indicator	100(1)	Set record - 1 Catch record - 2 Note: Keypunch only.
Species Code	101-104(4)	See species code list.
Kept Weight	105-109(5)	Direct code round weight to the nearest kg.
Discard Weight	110-113(4)	Direct code round weight to nearest kg. Note: Discarded fish is whole fish thrown over board.
Directed or Not	114(1)	Yes = 1 No = blank
Processing Code 1	115-117(3)	Use a Conversion Factor Processing Code (see Section VII of this Manual) to indicate the major end product obtained from this species (i.e. process which was carried out on the largest portion of the species total kept weight).

Table 1. (Cont'd.)

Field	Columns	Codes and Notes
Percent (%) 1	118-120(3)	Estimate the percentage of the total kept weight (whole fish), which was processed by means of Proc. Code 1 (Processing Method).
Processing Code 2	121-123(3)	Use a Conversion Factor Processing Code to indicate the 2nd major end product obtained from this species (i.e. process which was carried out on the 2nd largest portion (or remainder) of the species total kept weight) - if applicable.
Percent (%) 2	124-126(3)	Estimate the percentage of the total kept weight which was processed by means of Proc. Code 2 - if applicable.
Processing Code 3	127-129(3)	Use a Conversion Factor Processing Code to indicate the 3rd major end product obtained from this species (i.e. process which was carried out on the 3rd largest portion (or remainder) of the species total kept weight) - if applicable.
Percent (%) 3	130-132(3)	Estimate the percentage of the total kept weight which was processed by means of Proc. Code 3 - if applicable. Note: In the 'Processing' section of the Set and Catch sheet spaces are available for up to 3 Processing Codes and corresponding percentages. If any more than 3 processes are carried out on a given species, include them in the 'Comments' section.

APPENDIX 3: TABLE 2. LENGTH FREQUENCY SPECIFICATIONS.

Field	Columns	Codes and Notes
Card Number	1(1)	Keypunch operator (observer leave blank).
Set Number	2-5(4)	Set number is the number of the set from which the sample was taken.
Country (Quota)	6-7(2)	This category refers to the country whose whose quota is being fished. Bulgaria = 1 Canada (M&Q) = 2 Canada (Nfld.) = 3 Cuba = 4 Denmark (Faroes) = 5 Denmark (Greenland) = 6 Denmark (Mainland) = 7 France (Metro) = 8 France (St. P&M) = 9 FRG =10 GDR =11 Iceland =12 Italy =13 Japan =14 Norway =15 Poland =16 Portugal =17 Romania =18 Spain =19 USSR =20 UK =21 USA =22 Israel =23 Ireland =24
Species	8-11(4)	Code in species being sampled. Note: See species code list for codes.

Note: Header portion of large pelagic frequency is completed using the same specifications as the Groundfish length frequency above.

Table 2. (Cont'd.)

Field	Columns	Codes and Notes	
Sex	12(1)	1 = Male/5 = Female Blank = No Sex Note: If the species is sexed (male + female) code in $\frac{1.}{5}$ If species is unsexed, leave blank.	
Trip Number	13-15(3)	Fill in assigned trip number.	
Vessel Side Number	16-23(8)	Direct code the actual vessel side number (right justify).	
Tonnage Class	24(1)	Gross Tonnage	Code
		0-24.9	1
		25-49.9	2
		50-149.9	3
		150-499.9	4
		500-999.9	5
		1000-1999.9	6
		2000+	7
Gear Type	25-26(2)	Code as follows:	
		Otter trawl (stern)	1
		Otter trawl (side)	2
		Danish seine	3
		Cod trap	4
		Gillnet (fixed)	5
		Longline (line trawl)	7
		Handline (jigger)	8
		Scottish (seine)	9
		Purse seine	10
		Miscellaneous	11
		Unspecified	12
		Rake and tong	13
		Bar seine	14
		Gillnet (drift)	15
		Midwater trawl	16
		Shrimp trawl (unspecified)	17
		Pair trawl	18

Table 2. (Cont'd.)

Field	Columns	Codes and Notes	
		Salmon net	19
		Long line and gillnet	20
		Off bottom chain	21
		Automatic jigger	22
		Scallop dredge	23
		Off Bottom Box Trawl (Japan)	24
			25
			26
			27
			28
			29
		Sputnik 1200 Danish	30
		Sputnik 1400 Danish	31
		Sputnik 1600 Danish	32
		Sputnik 1800 Danish	33
		Sputnik 2000 Danish	34
		Sputnik 1200 Norwegian	35
		Sputnik 1400 Norwegian	36
		Sputnik 1600 Norwegian	37
		Sputnik 1800 Norwegian	38
		Sputnik 2000 Norwegian	39
		Sputnik (unspecified)	40
		Kalut (Danish)	41
		Kalut (Norwegian)	42
		Iver Christensen (Shrimp)	43
		Kalut (unspecified)	44
		Columbia (unspecified)	45
Mesh Size	27-29(3)	Actual mesh size of codend in millimeters. Note: If gillnet, actual mesh size of gillnet in millimeters.	
NAFO Division	30-32(3)	Actual division fished. 2J = 2J 3Ps = 3Ps 4Vs = 4Vs etc. Note: This is the only field that is left justified.	

Table 2. (Cont'd.)

Field	Columns	Codes and Notes
		Example: 2J is coded. 2 J Ungava Bay UB Baffin Island Subarea 0 0 1A 1A 1B 1B 1C 1C 1D 1D 1E 1E 1F 1F 2G 2G 2H 2H 2J 2J 3K 3K 3L 3L 3M 3M 3N 3N 30 30 3Pn 3Pn 3Ps 3Ps 4R 4R 4S 4S 4T 4T 4Vn 4Vn 4Vs 4Vs 4W 4W 4X 4X
Unit Area	33-34(2)	Insert last two digits of area codes, e.g. 302 = 02, 330 = 30, 410 = 10, etc.
Latitude	35-38(4)	Starting latitude to nearest minute.
Longitude	39-42(4)	Starting longitude to nearest minute.
Time	43-46(4)	Starting time (GMT) of tow.

Table 2. (Cont'd.)

Field	Columns	Codes and Notes
Use	47(1)	Specify whether the fish taken for measurement were: L = Landings, (What is put down after discarding.) C = Catch (what is actually in the net, no discarding. D = Discards.
Year	48-49(2)	1984 = 84
Month	50-51(2)	Jan = 1 Feb = 2 Mar = 3 Apr = 4 May = 5 June = 6 July = 7 Aug = 8 Sept = 9 Oct = 10 Nov = 11 Dec = 12
Day	52-53(2)	Actual day fished (that day on which the set commenced).
Quarter	54(1)	Jan-Mar = 1 Apr-June = 2 July-Sept. = 3 Oct-Dec = 4
Port (Country)	55-57(3)	This category refers to the flag state of the vessel. Use the country codes listed in category (Country (Quota)) columns 6-7.
Depth	58-61(4)	Fill in actual average depth to the nearest metre.

Table 2. (Cont'd.)

Field	Columns	Codes and Notes
Species Total Weight	62-67(6)	Species total weight will depend on use (Col. 47). If use is L, then species total weight should be the kept weight only of that species. If use is C, then species total weight should be kept weight + discard weight of that species (i.e. total species catch weight). If use is D, then species total weight should be the discard weight only of that species.
Sample weight	68-71(4)	Actual weight of the fish used for the frequency to the nearest kilogram.
No. of Otoliths	72-74(3)	Actual number of otolith - pairs collected from this frequency. Keep males and females separate.
Length Group	75(1)	Length groupings. 1 = 1 cm (e.g. redfish) 2 = 2 cm (e.g. flatfish) 3 = 3 cm (e.g. cod) See the last page of this section (II) for a complete list of length groupings.
	76-80	Not used.
	81-320	Note: 80-3 position field for lengths or groups of lengths from 1-80.

APPENDIX 3: TABLE 3. SHRIMP FREQUENCY SPECIFICATIONS.

Field	Columns	Codes and Notes	
Card No.	1(1)	Leave blank.	
Frequency No.	2-5(4)	Leave blank.	
Species	6-9(4)	Code actual species sampled.	
		Pandalus borealis	8111
		Pandalus montagui	8112
		Note: If requested to sample any other species use standard species codes.	
Vessel	10-11(2)	Vessel code is based on tonnage and is coded as follows:	
		Unknown	0
		0-24.9	1
		25-49.9	2
		50-149.9	3
		150-499.9	4
		500-999.9	5
		1000-1999.9	6
		2000+	7
Country	12-13(2)	Code as follows:	
		Canada M&Q	2
		Canada Nfld.	3
		Denmark Faroes	5
		Denmark Greenland	6
		Denmark Mainland	7
		Norway	15
		France (Mainland)	8
Trip No.	14-16(3)	Write in actual trip number assigned.	
Set No.	17-19(3)	Write in actual set number from which sample was taken.	

Table 3. (Cont'd.)

Field	Columns	Codes and Notes
Year	20-21(2)	1984 = 84
Month	22-23(2)	Jan = 1 Feb = 2 Mar = 3 Apr = 4 May = 5 June = 6 July = 7 Aug = 8 Sept = 9 Oct = 10 Nov = 11 Dec = 12
Day	24-25(2)	Actual calendar day on which set started.
Time NST	26-29(4)	Actual midpoint of tow must be written in N.S.T. (Newfoundland Standard Time). Note: Take the midpoint of the set (start time + ½ of the duration) and then subtract 3.5 hr from GMT to arrive at the midpoint in N.S.T.
Latitude	30-34(5)	Start latitude of set. Note: Last place is a decimal place. Example: code Lat 56°20'00"N as 56200. Lat 56°30'30"N as 56305. (i.e. $\frac{30}{60} = 0.5$)
Longitude	35-39(5)	Start longitude of set. See note for latitude.

Table 3. (Cont'd.)

Field	Columns	Codes and Notes	
Duration	40-42(3)	Duration of set must be in minutes. Example: duration 3 hr, 30 minutes is written 210.	
Bottom Type	43-44(2)	Leave blank.	
Depth	45-48(4)	Average depth of set to the nearest metre.	
Temperature	49-51(3)	Leave blank.	
Stock Area	52-54(3)	Code as follows:	
		NAFO 0 + 1	10
		NAFO 1A	11
		NAFO 1B	12
		NAFO 1C	13
		NAFO 1D	14
		NAFO 1E	15
		NAFO 1F	16
		NAFO 0A	20
		NAFO 0B	30
		Ungava Bay S. of 61°	40
		Hudson Strait N. of 61°	41
		NAFO 2G	50
		Hopedale Channel 2H	60
		Cartwright Channel 2J	70
		Hawke Channel 2J	80
		Funk Island Deep	90
		Trinity Bay	100
		Conception Bay	110
		St. Mary's Bay	120
		Placentia Bay	130
		Fortune Bay	140
		Ramea East (Hermitage Bay)	150
		Ramea West (Burgeo Bank)	160
		Banquereau	170
		Southern Gulf	180
		West of Anticosti Island	190
		Mingan Channel	200

Table 3. (Cont'd.)

Field	Columns	Codes and Notes	
Stock Area (cont'd.)	52-54(3)	Code as follows:	
		Esquiman Channel (South of 50°)	210
		Esquiman Channel (North of 50°)	220
Unit Area	55-57(3)	Code in actual NAFO unit area 210, 206, 330, etc.	
Stratum	58-60(3)	Leave blank.	
Gear	61-62(2)	Code as follows:	
		#36 shrimp	2
		Iver Christensen (shrimp)	4
		Kalut unspecified	13
		Sputnik unspecified	15
		Sputnik 1200	17
		Sputnik 1400	18
		Sputnik 1600	19
		Sputnik 1800	20
		Sputnik 2000	21
		Columbia 2350	22
		Esbjerg 1800	23
		Esbjerg 2200	24
Catch	63-67(5)	Actual catch to the nearest kilogram. This will depend on type of sample. If the sample is a commercial sample (catch), then the total species weight should be written in (Kept + discards). If the sample is a discard sample, then the discard weight only of the species should be written in.	

Table 3. (Cont'd.)

Field	Columns	Codes and Notes	
Ratio	68-72(5)	Ratio is obtained by dividing the total catch by the weight of the sample. Example: $\frac{\text{Total catch}}{\text{Sample weight}}$ $= \frac{1000\text{ kg}}{3.6\text{ kg}}$ $= 277.78$ Code this ratio as 2778.	
Sample Type	73(1)	Research (catch) Commercial (catch) Discard (from commercial catch)	1 2 4
Condition	74(1)	If the frequency contains ovigerous and non-ovigerous animals, code ½. If the frequency contains only non-ovigerous animals, code as 1. If the frequency contains only ovigerous animals, code as 2.	
Other Information			
Collector		Observer's name.	
Sample Weight		Total weight of shrimp measured in sample to the nearest $^1/_{10}$ of a kilogram. Example: Sample weight = 3.6 kg (specify kg). Note: Weigh carefully and subtract weight of bucket, pour off any excess water.	

Table 3. (Cont'd.)

Field	Columns	Codes and Notes
SST (Soft Shell Tally)		Is a tally of all the shrimp not able to be measured due to a soft shell. Note: SST shrimp should not be tallied in the frequency nor should they be included in the sample weight. Care should be taken not to call broken or damaged shrimp soft shelled.

APPENDIX 3: TABLE 4. GRENADIER FREQUNECY SPECIFICATIONS.

Field	Columns	Codes and Notes
Vessel	1-2(2)	All observer trips are coded 99 Note: Write in name of vessel in the left hand side of the box.
Cruise	3-5(3)	Fill in trip number assigned.
Stratum	6-8(3)	Leave blank.
Set	9-11(3)	Actual set number from which sample was taken.
Day	12-13(2)	Actual calender day on which set started.
Month	14-15(2)	Jan = 1 Feb = 2 Mar = 3 Apr = 4 May = 5 June = 6 July = 7 Aug = 8 Sept = 9 Oct = 10 Nov = 11 Dec = 12
Year	16-17(2)	1984 = 84
Division	18-19(2)	Code actual division fished: 2J = 2J 3K = 3K 3Pn = 3Pn etc.
Type	20(1)	Observer leave blank.

Table 4. (Cont'd.)

Field	Columns	Codes and Notes
Species	21-24(4)	Code as follows: Roundnose = 481 Roughhead = 474
No. Measurements	25-28(4)	Observer leave blank.
Ratio	29-30(2)	Observer leave blank. Note: Instead of filling in ratio column 29-30, fill in blank space below and to the right of column 29-30 with the sample weight/amount caught (species weight). See example on last page.
Sex	31(1)	Observer leave blank.
Gear	32(1)	Indicate type of gear. Otter trawl = OT Midwater trawl = MT
Time	33(1)	Fill in start time of set.
End Time	34(1)	Write in end time of set.
Grouping	35(1)	Always code as 5.
Collector's Name	-	Observer's name.

APPENDIX 3: TABLE 5. AGE AND GROWTH SPECIFICATIONS.

Field	Columns	Codes and Notes	
Card	1(1)	Leave blank.	
Species	2-4(3)	Code actual species. Note: See species code list for codes.	
Vessel	5-6(2)	Indicates type of frequency.	Code
		Catch	-C
		Landings	-L
		Discards	-D
Trip Number	7-9(3)	Actual trip number assigned.	
Set	10-12(3)	Actual set number on frequency.	
Year	13-14(2)	1984 = 84	
Month	15-16(2)	Jan	= 1
		Feb	= 2
		Mar	= 3
		Apr	= 4
		May	= 5
		June	= 6
		July	= 7
		Aug	= 8
		Sept	= 9
		Oct	= 10
		Nov	= 11
		Dec	= 12
Day	17-18(2)	Actual Day	

Table 5. (Cont'd.)

Field	Columns	Codes and Notes	
Country and Gear	19-20(2)	Code country as follows:	
		Bulgaria	= 1
		Canada (M&Q)	= 2
		Canada (Nfld.)	= 3
		Cuba	= 4
		Denmark (Faroes)	= 5
		Denmark (Greenland)	= 5
		Denmark (Mainland)	= 7
		France (Metro)	= 9
		France (St. P&M)	= 9
		FRG	=10
		GDR	=11
		Iceland	=12
		Italy	=13
		Japan	=14
		Norway	=15
		Poland	=16
		Portugal	=17
		Romania	=18
		Spain	=19
		USSR	=20
		UK	=21
		USA	=22
		Israel	=23
		Ireland	=24
	21-22(2)	Code gear as follows:	
		Otter trawl (stern)	1
		Otter trawl (side)	2
		Danish seine	3
		Cod trap	4
		Gillnet (fixed)	5
		Longline (line trawl) LL	7
		Handline (jigger)	8
		Scottish (seine)	9
		Purse seine	10
		Miscellaneous	11
		Unspecified	12
		Rake and tong	13
		Bar and seine	14
		Gillnet (drift)	15
		Midwater trawl	16
		Shrimp trawl (unspecified)	17
		Pair trawl	18

Table 5. (Cont'd.)

Field	Columns	Codes and Notes	
		Longline and gillnet	20
		Off bottom chain	21
		Automatic jigger	22
		Scallop dredge	23
		Off Bottom Box Trawl (Japan)	24
			25
			26
			27
			28
			29
		Sputnik 1200 Danish	30
		Sputnik 1400 Danish	31
		Sputnik 1600 Danish	32
		Sputnik 1800 Danish	33
		Sputnik 2000 Danish	34
		Sputnik 1200 Norwegian	35
		Sputnik 1400 Norwegian	36
		Sputnik 1600 Norwegian	37
		Sputnik 1800 Norwegian	38
		Sputnik 2000 Norwegian	39
		Sputnik (unspecified)	40
		Kalut (Danish)	41
		Kalut (Norwegian)	42
		Iver Christensen (Shrimp)	43
		Kalut (unspecified)	44
		Columbia (unspecified)	45
Division	23-24(2)	Code as follows:	
		Ungava Bay	= 6
		Baffin Island-Subarea Zero	= 9
		Division 1A	= 11
		Division 1B	= 12
		Division 1C	= 13
		Division 1D	= 14
		Division 1E	= 15
		Division 1F	= 16
		Division 2G	= 21
		Division 2H	= 22
		Division 2J	= 23
		Division 3K	= 31
		Division 3L	= 32
		Division 3M	= 33
		Division 3N	= 34
		Division 30	= 35

Table 5. (Cont'd.)

Field	Columns	Codes and Notes
		Subdivision 3Pn = 36
		Subdivision 3Ps = 37
		Division 4R = 41
		Division 4S = 42
		Division 4T = 43
		Subdivision 4Vn = 44
		Subdivision 4Vs = 45
		Division 4W = 46
		Division 4X = 47
Unit Area	25-27(3)	Code in actual unit area.
Depth (fished)	28-31(4)	Actual depth fished in metres to nearest metre.
Depth (bottom)	32-35(4)	Actual bottom depth in metres. Use when depth fished is not bottom depth, such as with a midwater trawl.
Temperature	36-38(3)	Leave blank.
Sample Type	39(1)	Observers always code. Stratified = 7.
Specimen Number	40-44(5)	Consecutive numbers 1-9999.
Length	45-47(3)	Actual length in centimeters.
Sex	48(1)	Male = 1
		Female = 5
		Unknown = blank

All other categories are to be left blank by observers.

APPENDIX 3: TABLE 6. CONVERSION FACTOR DATA SUMMARY SPECIFICATIONS.

Field	Columns	Codes and Notes
Trip No.	(1-3)3	Fill in assigned trip number.
Side No.	(4-9)6	This field is coded using the actual side number of the vessel.
Species code	(10-13)4	Code in species used in experiments see species code list for codes. Note: When performing experiments on more than one species of fish use a separate sheet for each species.
Country	(14-15)2	Code country of vessel as follows:

Bulgaria	= 1
Canada (M&Q)	= 2
Canada (Nfld.)	= 3
Cuba	= 4
Denmark (Faroes)	= 5
Denmark (Greenland)	= 6
Denmark (Mainland)	= 7
France (Metro)	= 8
France (St. P&M)	= 9
FRG (West Germany)	=10
GDR (East Germany)	=11
Iceland	=12
Italy	=13
Japan	=14
Norway	=15
Poland	=16
Portugal	=17
Romania	=18
Spain	=19
USSR	=20
UK	=21
USA	=22
Israel	=23
Ireland	=24

Table 6. (Cont'd.)

Field	Columns	Codes and Notes
Sample No.	3	Number experiments consecutively starting at one for each trip. Note: You may be required to perform more than one experiment on the same fish. If so, each result is assigned a separate experiment number.
Set No.	3	Code in actual set # from which the fish for the experiment were taken. Note: This information can be taken from the set and catch sheet.
Date	6	Code actual year, month, and day for the set from which the fish were taken for the experiment. (Y) Year 1984 = 84. (M) Month Jan = 1 Feb = 2 etc. Dec = 12 (D) Day Actual day fished 1-31
Process Method	3	See attached list next page.

Table 6. (Cont'd.)

Field	Columns	Codes and Notes
Whole Weight	3	Actual weight of fish used for experiment to the nearest kilogram (whole weight). Note: Take great care in weighing and be sure to subtract your basket weight.
Product Weight	3	Actual weight of fish product obtained from original sample after processing has been completed.
Conversion Factor	5	The conversion factor represents the factor used to convert product weight to round weight. It is obtained by dividing the whole weight by the product weight. Example: $\frac{\text{Whole weight}}{\text{Product weight}}$ $= \frac{172 \text{ kg}}{106 \text{ kg}}$ = 1.62 (Conversion factor) Note: All conversion factors must be rounded off to two decimal places. Example 1: 1.62 is coded 1.62 Example 2: 3.7 is coded 3.70 Example 3: 2 is coded 2.00.
No. of Fish	3	Code the actual number of fish used in the experiment. Note: Fish used in each experiment have been measured on a length frequency which will give # of fish.

Table 6. (Cont'd.)

Field	Columns	Codes and Notes
Mean Length	3	Determine the average length of all fish used in the experiment and record this length to the nearest cm. Note: To determine mean length take the midpoint of each stratum or length group and multiply it by the number of fish in that stratum. Do the same for all strata. Take the totals for all strata and add them together. This will give you a total length for all the fish. Divide that total by the number of fish in the sample. The number you obtain will be the average or mean length of the fish used in the experiment. See mean length calculation on the attached length freuquency.
Machine Type	4	Machines used in processing usually give the brand name and a numeric designation. For the purposes of coding this form, place the first letter of the brand name and the numeric designation in the space provided. Examples: Baader 440 is coded as B440 Circular Saw (of any brand) is coded as C100 Over a period of time a formal code list will be established.

Table 6. (Cont'd.)

Field	No. of digits	Code	Description and Notes
Problem Type	2	2	Minor adjustments to processing equipment by the crew in order to enhance product yield (machines more finely tuned than normal).
		3	Major adjustments to processing equipment by the crew in order to enhance product yield.
		4	Hand trimming procedures more carefully done than is typical (removal of blood spots and fins) leading to greater yield.
		5	Reduced edge trimming on the top quality products leading to abnormally higher yield (refers to trimmed products only).
		6	Minor adjustments to equipment and more careful hand trimming procedures conjunctly leading to abnormally higher yield ("untrimmed product").
		7	Major adjustments to equipment and more careful hand trimming procedures leading to high yield ("untrimmed product").
		8	Minor adjustments to equipment and reduced edge trimming (trimmed product only).
		9	Major adjustments to equipment and reduced edge trimming (trimmed product only).
		10	Lost product (less than 1% of yield), atypical of this equipment.
		11	Lost product (1-3% of yield), atypical of this equipment.
		12	Lost product (greater than 3% of yield), atypical of this equipment.
		13	Lost product (less than 1% of yield) due to improperly set equipment or crew interference. This was the typical situation throughout the trip.

Table 6. (Cont'd.)

Field	No. of digits	Code	Description and Notes
		14	Lost product (1-3% of yield) due to improperly set equipment or crew interference. This was the typical situation throughout the trip.
		15	Lost product (greater than 3% of yield) due to improperly set equipment or crew interference. This was the typical situation throughout the trip.
		16	Poor quality fish (i.e.-fish gone soft from extended deck storage) leading to jamming of equipment and resulting in reduced yield.
		17	Addition of product by the crew during an experiment, leading to artifically increased yield.
		18	Enlarged gonads in the fish being processed possibly contributing to a reduced yield.
		19	Full stomachs in the fish being processed possibly contributing to a reduced yield.
		20	Oversized or undersized fish being forced through the equipment leading to reduced yield.
		21	Headed fish (ungutted) with partial removal of viscera with the head.
		22	Excessive removal of meat during processing due to improperly tuned or ageing equipment (typical of the operation).
		23	Not the dominant process for this trip.

Table 6. (Cont'd.)

Field	Columns	Codes and Notes
NAFO Div.	3	Code actual NAFO Division of the set from which the fish were taken for the experiment. 2J = 2J 3Ps = 3Ps 4Vs = 4Vs etc. Ungava Bay UB Baffin Island Subarea 0 0 1A 1A 1B 1B 1C 1C 1D 1D 1E 1E 1F 1F 2G 2G 2H 2H 2J 2J 3K 3K 3L 3L 3M 3M 3N 3N 30 30 3Pn 3Pn 3Ps 3Ps 4R 4R 4S 4S 4T 4T 4Vn 4Vn 4Vs 4Vs 4W 4W 4X 4X
Sample Type	1	1 = Random 2 = Machine Random 3 = Size Selected.

APPENDIX 3: TABLE 7. CONVERSION FACTOR PROCESSING CODES

001 - Whole (round frozen or iced)
010 - Head off, unspecified cut
011 - Head off, straight cut, collar bone in
012 - Head off, straight cut, collar bone out
013 - Head off, v-cut, collar bone in
014 - Head off, wedge-cut, collar bone in
015 - Head off, round-cut, collar bone in
100 - Gutted
103 - Gutted, head off, straight cut, collar bone in
104 - Diagonal cut, gut and belly flap removed, collar bone out
106 - Gutted, head off, straight-cut, collar bone out
107 - Gutted, head off, v-cut, collar bone in
108 - Gutted, head off, wedge-cut, collar bone in
109 - Gutted, head off, round-cut, collar bone in
110 - Gutted, head off, unspecified cut
113 - Gutted, head and tail off, fins removed

120 - Gutted, head off, tail off
121 - Gutted, head and tail off, fins trimmed
122 - Gutted, head and tail off, fins trimmed, scaled
126 - Gutted, head off, fins trimmed

128 - Gutted, head and Tail off, Fins off (Porbeagle)
129 - Gutted, head on, gilled
130 - Gutted, head off, soundbone removed, fresh (split fish)
135 - Gutted, head off, soundbone removed, salted (split fish)

200 - Fillets, skinless, boneless, trimmed (v-portion with spines removed, peripheral flesh removed)
201 - Fillets, scaled, boneless, trimmed (v-portion with spines removed, peripheral flesh removed)
202 - Fillets, skin on, scales on, boneless, trimmed (v-portion with spines removed, peripheral flesh removed)
203 - Fillets, skinless, bone in, trimmed (peripheral flesh removed)
204 - Fillets, scaled, bone in, trimmed (peripheral flesh removed)
205 - Fillets, skin on, scales on, bone in, trimmed (peripheral flesh removed)
206 - Fillets, skinless, bone in, blood spots and fin bits not removed. (directly off the skinning machine, untouched by hand)
207 - Fillets, skin on, bone in, blood spots and fin bits not removed (directly off the filleting machine, untouched by hand)
210 - Fillets, skinless, boneless, (v-portion with spines removed, peripheral flesh intact)

APPENDIX 3: (Cont'd)

211 - Fillets, scaled, boneless, (v-portion with spines removed, peripheral flesh intact)
212 - Fillets, skin on, scales on, boneless, (v-portion with spines removed, peripheral flesh intact)
213 - Fillets, skinless, bone in, (peripheral flesh intact)
214 - Fillets, scaled, bone in, (peripheral flesh intact)
215 - Fillets, skin on, scales on, bone in, (peripheral flesh intact)

Note All 200 series processes (except 206 and 207) have fin bits and blood spots removed by hand. This is not defined as trimming. Trimming is the removal by hand, of additonal peripheral flesh to yield a uniformly thick product with no ragged edges.

300 - V-cut fillets, skinless, trimmed (peripheral flesh removed)
301 - V-cut fillets, scaled, trimmed (peripheral flesh removed)
302 - V-cut fillets, skin on, scales on, trimmed (peripheral flesh removed)
310 - V-cut fillets, skinless
311 - V-cut fillets, scaled
312 - V-cut fillets, skin on, scales on

Note: V-cut fillets are the result of a special process involving the removal of a large portion of the belly flap and spines.

403 - Topside fillet only, skinless, trimmed
405 - Topside fillet only, skin on, trimmed
413 - Topside fillet only, skinless
415 - Topside fillet only, skin on

Note: The 400 series applies mainly to Turbot. The term 'trimmed' is the same as for the 300 series.

503 - Livers
504 - Bodies (head off, gutted, topside fillet removed) turbot
505 - Head only (eg. turbot)
506 - Bodies and livers
510 - Tail off (bobtailed)
511 - Skate wings

600 - Cooked peeled frozen (shrimp)
610 - Cooked frozen (shrimp)
611 - Raw frozen (shrimp)

700 - Tubed (squid)

799 - Oil (reduction)
800 - Meal
801 - Canned product (whole fish)

900 - Crew consumption